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THAT branch of the Grand Trunk's invasion of New England which relates to securing a tide water terminal at Providence against the opposition of the New York, New Haven & Hartford has come to a new and advanced stage. After much controversy before the Rhode Island legislative committee, a decision has been reached; it is in the nature of a compromise, with advantage to both companies as well as to the municipality. The Grand Trunk sought the right of crossing the New Haven's main line at grade and the use of the New Haven terminals. These the Canadian corporation has not obtained, but it has secured a pledge from the New Haven company of payment of the difference between what may be termed the grade crossing entrance and a new entrance on sunken tracks; and the Grand Trunk must look out for its own tide water facilities. The alternative before the New Haven was evidently a compromise of this kind or facing a legislative act giving the Grand Trunk use—of course for compensation—of the New Haven's terminal and, beyond, a long controversy in the courts over the constitutionality of the measure, with uncertain results. The conflict of the two companies now reaches its climacteric point. Hitherto it has been limited to questions before the Rhode Island and Vermont legislatures and the Massachusetts railway commission, and to the New Haven defensive strategy exampled by the Rutland semi-control, the Montpelier & Wells River purchase and the Boston & Albany joint lease obligation. But on neither side has there been the threatened new rival construction, nor, so far as known, diversion from the Grand Trunk of business originating on the Boston & Maine. In an essential sense the campaign in New England now passes from the domain of strategy and law into that of concrete expense, into that stage where "dollars talk."

THE agricultural activities of the railways are becoming more varied every day. The Pennsylvania Lines west of Pittsburgh are running a train for the Ohio State Agricultural College for the express purpose of dealing with difficult questions which have been encountered by the farmers *since this spring's planting.* The Pennsylvania people are "on the job" surely. Another manifestation of this widespread change in our modes of life is to be found in the activities of the Illinois Central in Mississippi. This road, we are told, "by co-operation of its industrial, immigration and freight traffic departments proposes to offer special inducements to farmers in the stricken boll weevil districts and abandoned land sections to cultivate their acreage for corn and other grains. An effort will be made to get buyers to take the product as fast as it is known what it will be." . . . Efforts to get buyers will be a new kind of activity for railway officers; though it cannot be doubted that such activities may be made profitable to the shipper, the railway and the public. But the road that turns its enterprise in this direction is wandering a good way out of the narrow path marked out by the Interstate Commerce Commission when it frowns on the expenditure by a railway of 25 cents for a telegram which may be of some little benefit to a shipper. Where shall we find the Act to Regulate Commerce, at this rate? It will be knocked into a cocked hat. From hunting up buyers for corn we shall soon descend to the trick of encouraging marriageable young men to seek wives in distant towns in order to increase the profits of the passenger trains. Think of a passenger agent sending in a voucher for expenses in introducing city swains to farmers' daughters! Professor Adams would spend the whole of his $350,000 appropriation before he would approve such an expenditure; and yet even worse things are being legitimized rapidly by the force of custom. Not all of the Washington officials are critical, however. Professor Adams is a cold-blooded accountant; but the cabinet members are human, and we find the Secretary of the Interior requesting the Southern Pacific Company to publish in its folder warnings of the danger of forest fires. "The interior department is doing everything possible to spread knowledge of this danger, and the railways are co-operating, so that campers and excursionists who travel

to the forests will be made aware of the dangers of building or leaving camp fires in the thickly forested areas." The Southern Pacific is going to comply with the request. Thus we have one more example of businesslike and friendly philanthropy between the government and the railways.

ONE bad result of recent advances in the wages of railway employees is that in a good many cases certain classes of employees are receiving wages as high as, or higher than the wages of their superior officers. On some lines road enginemen are receiving an average of $6.30 a day, firemen $4.15, conductors $5, flagmen $3.65, and brakemen $3.50. The wages earned by the best paid employees exceed these amounts, being as much as $7.25 to $10.50 for enginemen, $4.40 for road firemen, $6 for conductors, and $3.95 for road flagmen. On the same roads, officers are receiving sauaries which figure out as follows, per day: Trainmasters $7.77 to $9.70; assistant trainmasters $6 to $7.07; road foremen of engines $6.83 to $7.77; assistant road foremen of engines $4.83 to $6; yardmasters $3.33 to $4.89. In some cases a night yard brakeman, working the same number of hours and days as a yardmaster, gets $130 a month, which is more than the average received by the yardmasters on the roads where the wages in question are paid. There probably are numerous cases where conductors and enginemen on good runs make more than the trainmasters. The seniority rule, as insisted on by the labor unions, tends to prevent the promotion of employees to official positions. The existence of an arrangement under which employees get higher wages than the officers immediately above them is adapted to deaden their ambition. The officer, of course, has the advantage of being in line for promotion to higher positions in the operating department, but the number of employees who are apt to work hard for promotions involving reductions in their incomes in order to get in line for further promotions is not large. The knowledge on the part of employees that they are receiving larger incomes than those who give them orders is as little adapted to promote good discipline as it is to stimulate the ambition and the exertions of employees. Viewed from any standpoint, the situation is most unsatisfactory. Either in many cases the employees are being paid too much, or the officers are being paid too little. The inconsistencies in railway wages and salaries are not confined to the wages of train employees and their superior officers. The wages of clerical employees in division and general offices have not been increased in anything like the same proportion as the wages of train employees. Perfect consistency in the payment of wages and salaries has never been attained in any business, and never will be. There are always some who get more than they are worth, and others who are worth more than they get. But the inconsistencies in the existing payrolls of the railways are too glaring to be tolerable for long, because they are so great and indefensible that they tend directly and in a serious measure to cause inefficiency.

SEEKING A "BASIS" FOR RATE REGULATION.

HOWEVER much those considering the problem of rate-making and rate regulation may differ regarding other matters, there is one point on which all agree—at least in the abstract. This is that fundamentally the problem is one of public expediency, and that it should be settled solely with a view to furthering the public welfare in the long run. No doubt, also, all will agree that the constant and prolonged agitation of the subject is contrary to the public interest. It would be better to have it settled on some basis, even though that basis were not exactly the best one, than to continue perennially the controversies and litigation about what basis shall be adopted. Perhaps, also, all intelligent persons can be convinced that in fixing the relations between the rates on different commodities, and on the same commodities for different hauls, both the cost of the service and the value of the service must be given due consideration, the latter principle usually being given preponderant weight. Everyone can see that the rates on sand and automobiles ought not to be the same per ton per mile.

But everyone cannot be persuaded that when fair relations have been established between the different rates, and traffic moves freely under them, the rate problem is solved. The shippers, as a whole, are apt to continue to insist that rates, as a whole, are too high, and the railways that they are too low; the former basing their contention on the ground that the railways are making too much money, and the latter theirs on the ground that they are making too little. In other words, the total return of railways from all their rates is generally regarded as a very important element in determining the reasonableness of their rates as a whole. It has been held to be such by the courts. But in order to ascertain what the return is it is necessary to compute it on some basis. The railways with high capitalization would like to compute it on the basis of capitalization; those with low capitalization, on the value of their properties. The shippers are equally consistent; they would compute the return of roads with a high capitalization on the value of the properties, and the return of roads with a low capitalization on their capitalization!

If the Supreme Court of the United States upholds the decision of Judge Sanborn in the Minnesota rate case, the question of the basis of computing the fairness of a railway's return will be moved a long way toward settlement. He held that the proper basis is the cost of reproduction, new. He also held that each of the railways involved in the litigation in Minnesota is entitled to a net return of 7 per cent. The Supreme Court of the United States held that the Consolidated Gas Company of New York was entitled to 6 per cent. It might hold that eastern railways are entitled to this return; that those situated similarly to the Minnesota lines are entitled to 7; and railways in the extreme western part of the country to 8 per cent.

There are some important points, however, which will be left entirely unsettled, even though the Supreme Court upholds the Minnesota rate decisions. One of these is as to how, if cost of reproduction be accepted as the proper basis for regulating railway rates, as a whole, they shall be so adjusted as to enable each of a group of competing roads to earn this return. Different roads vary greatly in their operating expenses and in the density and nature of their traffic, as well as in the value of their physical plants. It would be impossible, therefore, to make all of a group of competing roads earn the same percentage of return on their valuations with the same freight and passenger rates. Yet all their rates between competitive points must be the same; and if any fair relation is to be maintained between competitive and non-competitive rates the latter must be made with some reference to the former. Valuation based entirely on cost of reproduction ignores the fact that two roads having plants whose physical cost of reproduction would be the same may, viewed from any rational standpoint, have very different values. As the road having the greater density of traffic and the proportionately lower operating expenses will, while charging exactly the same rates, render more service to the public and earn more money for its owners, it is obviously the more valuable road. Is it not, therefore, entitled to a higher valuation?

While it is easily demonstrable that, of two railways with equally good physical plants, the one having the relatively larger business and the relatively lower operating expenses is the more valuable, the value of a difference in volume or quality of traffic, or in operating expenses, cannot be expressed in terms of money until it emerges in net earnings; and it can only emerge in net earnings after rates expressed in money have been applied to the traffic. Possibly, however, there is a way in which, while using *physical* valuation as a basis for regulating rates and profits, we might secure to each railway the benefit of all elements entering into its value as a going concern.

It might be found, if a physical valuation were made, that some roads could not earn the current rate of interest on their valuations without charging rates which would interfere with

the movement and growth of traffic. They would have to be denied a right to earn a "fair return," for the right of a railway to earn any return is subordinate to the right of shippers and travelers to reasonable rates. Just above this class of railways would be found others in all parts of the country, which would, perhaps, be just able, with rates that would not oppress the traffic, to earn a fair return on their cost of reproduction. It would seem they could not be restricted to less.

Still above them would be found everywhere roads, which, on the same rates, could earn more, and in some cases much more, than the current rate of interest on their physical valuations. Should they be permitted to do so? While they could earn larger percentages of return on their *physical* value, their percentages of return on their *total* value, including their physical value and their utility to the public and to their owners, as evidenced by the amount of business that they handle and the economy and efficiency with which they handle it, might be no larger. Even if some railways did earn large profits this would not be proof, either legal or economic, that their rates were excessive. The fact that other fairly well managed roads in the same territory, charging the same rates, earned no more than a fair return on the physical value of their properties would be strong evidence that the rates were reasonable and that the larger profits of these more prosperous roads were due largely to differences of management.

Letting the more successfully managed roads earn more than the less successfully managed would tend to foster efficient management on all; no stimulus to the use of enterprise and skill is so potent as allowing enterprise and skill to garner and enjoy the fruits that they have nurtured. It would not necessarily result in any case in entirely excessive profits; the courts have held that where the profits of a railway are "truly enormous" this raises a presumption—although not a conclusive one—of the unreasonableness of its rates. If, however, the average rate of return in the railway business were no greater in proportion than the average in other businesses, such as banking, farming and manufacturing, and the profits of none of the railways were larger than those of well managed concerns in other lines of enterprise where competition was active, it would seem it could hardly be concluded that they were so great as to raise a conclusive presumption of the unreasonableness of their rates.

Valuations have been made in a number of states: In Washington, South Dakota, Michigan, Minnesota and Wisconsin the aggregate capitalization was $1,276,949,698, and the aggregate estimated cost of reproduction was $1,211,806,522. The only one of these estimates of cost of reproduction, new, which has been passed on by a federal court is that in Minnesota. Whereas the commission's estimate of the cost of reproducing the Great Northern, the Northern Pacific and the Minneapolis & St. Louis in Minnesota was $193,000,000—which was greatly in excess of their capitalization in that state—the court's finding amounted to $250,000,000 The result of litigation in other states probably would not be different. Wherever valuations have been made by railway commissions, they have been made more with a view to finding a basis for reducing rates than for regulating them; and those who set out to devise means for reducing rates are pretty apt to *find* means for reducing rates! Railway managers have long been of the opinion that valuation would show that the present value of the property of the railways is much greater than their capitalization, and the result of the litigation in Minnesota tends to justify the confidence that they have expressed. But even if a valuation should be so high as to give the roads legal license greatly to raise their rates, it might not be practicable for them to take anything approaching full advantage of it. The public notion has been that the railways are not only over-capitalized but that they have so adjusted their rates as to pay a return on their watered stock. If it were so easy to adjust rates on the basis of valuation or capitalization there would never have been any bankrupt railways. Railways have had to make rates which the traffic would bear and with which they could meet the competition of each other and the water carriers. Thus conditioned, they have been unable so to adjust them as to earn a given return on their aggregate capitalization, however much they have longed to do so. They would be confronted with similar conditions after a valuation was made, and if their aggregate valuation, like their aggregate capitalization in the past, were such that rates could not be so adjusted as to earn a return on all of it, they would have to go without any return on parts of it. A valuation might at least serve to satisfy the public on the question of whether or not the railways are earning more or less than a fair return; and if the public must have a "basis" for regulating rates, it probably would offer one high enough to prevent any great harm being done to anybody.

On the whole, therefore, it would seem that all interests can afford to look on the agitation for a national valuation with tranquility of spirit; and the railways most of all, for its effect would be much more apt to justify some advance in the general level of rates than any considerable reduction in it.

CORROSION AND PROTECTION.

THE wholesale destruction of iron and steel by corrosion is a depreciation loss in which the railways are vitally interested, as they are large users of steel in structures which are exposed to corrosive conditions to an unusual degree. In 1907 the consumption of steel plates, shapes and axles for metal railway cars was two million tons, and the steel rails rolled that year amounted to three and one-half million tons. To this, add a large tonnage of structural material for bridges, trestles, steel buildings, tanks, etc., and it will be found that the railways consume nearly one-third of the total production of steel in the United States. There is a great loss by corrosion of this material, and the expense of the various efforts made by the roads to protect it is larger than that in any other single industry.

Considerable progress has been made in the past few years toward a better understanding of the corrosion problem, and in the art of protecting iron from rapid decay. The expensive failures of some methods of protection will not be repeated and some valuable lessons have been learned which will lead to the use of coverings that approach more nearly to a permanent protection.

The steel framework of the roof of a large trainshed in Chicago was recently replaced after a few years' service, as it was found that the covering made of cinder concrete slabs had cracked and allowed steam and sulphur gases from the locomotives to penetrate, and coming in contact with the cinders resulted in a chemical action which caused a rapid corrosion of the steel reinforcement. The rust of the latter expanded and caused further cracks, which allowed more gas and moisture to penetrate the steel framework, with such destructive effect as to require entire renewal. The sulphur gases and moisture from smoke stacks have also destroyed a large amount of elevated railway structures in St. Louis. These structures were covered with cinder concrete, but this failed as a protection against corrosion. These are only prominent examples of a large amount of steel work which has been partly destroyed through the failure of the means used for their protection, and which must be replaced at a large expense. Records kept by one of the large railways, relating to steel hopper cars used in coal traffic, show a loss of 700 lbs. per car per year due to corrosion, and the large area of thin steel surface exposed to corrosion in this class of equipment is causing a very large annual depreciation. The proper method of painting steel cars during construction and in service, so as to prevent this rapid destruction, is a subject which has received much serious attention by the painter, and is now being given that scientific investigation by the chemist which the great importance of the subject demands.

Much of the corrosion of steel track materials and structures is attributed to the salt water dripping from refrigerator cars, but that condition can be improved, as the meat cars are the only ones which require salt, and the ice tanks are now made large enough to hold the accumulated brine between icing sta-

tions. It is probable that the sulphur in the ashes and cinders from the locomotive is a more destructive agent to track structures. This condition is likely to become worse by reason of the general use of self-dumping ash pans now required by federal law, and which, on account of their construction, are often leaky and difficult to keep entirely tight.

The scientific investigation of the cause of corrosion has no where been more thorough or more illuminating than that by Dr. Allerton S. Cushman, and his papers on electrolytic action as a cause of corrosion are well known. In a recent address before the Franklin Institute on the Conservation of Iron, Dr. Cushman showed that the consumption of iron ore in proportion to population is increasing more rapidly than that of any of the other staples, that the present generation may see the exhaustion of high-grade ores in this country, and that the use of lower grades must largely increase the cost of pig iron and its products.

The electrolytic theory of corrosion affords a logical explanation as to why steel which is made so rapidly that the impurities are badly segregated is more subject to corrosion than pure metal made by slower and more careful processes. This has led to new metallurgical processes, by which iron of excellent quality and remarkably pure is made in open hearth furnaces on the same large scale as is employed in steel manufacture. The particular value of pure iron is that it corrodes slowly and uniformly, and there is not the tendency to pit as is the case in less homogenous metal. This metal can be used for sheets or tubes where the element of strength is not important. It is possible that pure irons may be used as a base and alloyed with nickel, copper or other metal in the production of a strong structural metal which will be much less subject to corrosion than the carbon steels as now manufactured.

Steel can be protected from rust by a coating of black oxide of iron, or by rolling zinc on to the surface, as in the Speller process, and while this adds to the expense, it is frequently an economic measure where corrosion is to be avoided. It is not generally realized by engineers that it is not best to bring in contact in one construction metals of unlike electro-chemical properties, and iron and steel have been destroyed in large quantities on account of a lack of knowledge of these relations.

Zinc is particularly valuable in preventing corrosion due to electrolysis, as it is electro-positive to iron and will protect iron or steel at its own expense as long as it is kept in contact with it. The bare ends of galvanized wire do not rust on exposure, and it is important that in the use of zinc for protection the coating must be of sufficient thickness to allow for some loss of the metal by electrolysis, as, if the coating is very thin, it will be gradually destroyed and the iron left bare.

There is an important difference between the value of zinc as a protective coating and of tin, lead or copper. The latter three are electro-negative to iron, and, theoretically, they should not be used for such a purpose. Any crack in tin-protected iron will lead to more rapid corrosion than if the tin were absent, as the burden of the attack is thrown upon the iron in the couple. Aluminum and magnesium are electro-positive, but alloys of these metals suitable for iron protection have not been manufactured, and the cost in most cases would be prohibitive.

Paint coatings for the protection of iron or steel will not now be considered in detail, but a great improvement has been made in the manufacture of paints for such purposes as a result of Dr. Cushman's investigation. He first called attention to the fact that the pigment portion of paint has an important relation to corrosion, and that certain pigments in contact with iron render it chemically passive, and, therefore, for the time, non-corrosive. The best agents for this purpose in paint manufacture are slightly soluble chromates and other substances which form with iron a distinctly alkaline reaction. The test plates of iron and steel covered with paints made on this principle have been exposed at Atlantic City for three years and the last inspection of them shows that they are effective protectors, and they are leading to decided improvements over the ordinary paints used for the protection of iron and steel.

NEW BOOKS.

Loose-Leaf Pocket Book. By Norman R. Corke, A. M. I. E. E. Published by John Walker & Co., Ltd., London, Eng. The Cooke & Cobb Co., Brooklyn, N. Y., agents for the United States. Morocco, leather lined; 4 in. x 6 in. Price, $4.

This pocket book is especially adapted for mechanical, civil and electrical engineers. It was originated to supplement the use of engineers' hand books, which are generally too large to be conveniently carried about. It contains 50 pages of useful tables, formulae, etc., condensed into the smallest possible space and arranged for easy reference. Co-ordinate, plain and ruled pages are provided to permit the engineer to inclose data of his own, pertaining directly to his special work. The pages are made of special, tough, thin paper, and are provided with or without metallic eyelets, according as the notes are for temporary or permanent use. The advantage of this book is that it never becomes obsolete, as its contents may be readily removed or added to. It is well and strongly made of good material, and will stand hard usage.

The Supply Department. By H. C. Pearce, General Storekeeper, Southern Pacific Company. 120 pages; 13 illustrations; 6 in. x 9 in. The Railroad Gazette, New York. Price, $2.00.

This is a study of the purposes, organization and operation of the supply department. It was published serially in the *Railway Age Gazette* this winter. While the advantages and disadvantages of different systems are discussed, the book is chiefly an exposition of the centralized system under which one man is at the head of a department which attends to both storekeeping and purchasing, the movement of all supplies, whether inter-departmental or from outside sources, being controlled by one organization. Mr. Pearce develops and explains the plan logically and fully. Beginning with purposes and organization, he then discusses the duties of officers and the layout and facilities for general and division stores. Having thus placed the system clearly before the mind of the reader, he goes on and shows, how to do business with the given organization and facilities. We are indebted to Major Charles De Lano Hine for the following:

"It is a great pleasure to respond to a request for a 'postscript' to The Supply Department by an old Rock Island and Southern Pacific friend, H. C. Pearce. By their works ye shall know them, and 'Pearce, he delivers the goods.' Some storekeepers put all the accent on the *keep* and unconsciously regard the practical *issue* of material as something of a nuisance. Not so with Pearce, he is up and shipping, and, best of all, as his chapters show, he assembles the material and supplies, in rational arrangement, making the 'job of work' a unit of supply.

"The Soo Line gave our profession Pearce as well as his former bosses, Underwood, Willard and Pennington, all influenced, more or less, by the broad views and comprehensive policy of that many sided genius, Sir William Van Horne. The great northwest has developed its quota of all 'round men, while the denser East—beg pardon, the East of denser traffic—has turned out specialists. The most undesirable corollary of specialization is centralization, which is the direct opposite of self contained concentration. Therefore, if my friend Pearce in our talkfests would let me interlock supply with the higher speed route, operation, by making the supply head an assistant general manager, and each division storekeeper an assistant superintendent, I would say 'Amen' to all his conclusions.

"So terribly in earnest is Pearce that he takes little for granted, leaves nothing to chance, and works out his plans and classifications in advance. On his neat desk in the general office building in San Francisco is compact, concise information showing him the master of his situation, saving the Southern Pacific thousands and thousands of dollars every year. No man in the country has done more, if as much, to originate and develop methods for the supply car which he so happily describes as a 'transfer store.' No man is more enthusiastic in developing, by precept and example, higher standards of efficiency and integrity. Happy is the man who has found his work, and fortunate are we to have in instructive form the lessons of that work."

Letters to the Editor.

A TERRIFYING ADVERTISEMENT.

TEMPLE, TEX., April 8, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

While passing the city ticket office of one of the great transcontinental systems (Harriman Lines) in Chicago the other day, my attention was called to a beautiful picture, evidently a colored photo-engraving, showing a passenger train standing at an automatic block signal indicating stop. This view is evidently designed to impress upon the public the high degree of safety maintained by a combination of discipline and signals on the road in question; and but for one slight defect the psychological results upon prospective travelers would be perfect. Unfortunately, the scene is on a single track road and there is another signal, governing in the opposite direction, directly across the track from the one at which the train has stopped, and this signal indicates *proceed.* So vivid is the impression that one almost expects to witness a butting collision. One is led to query if it would not be a good idea to have surprise checking for advertising agents and their artists as well as for trainmen. V. C.

["V. C." has our sympathies. The picture maker always seems to succeed in having the last word. In laying out a picture he has no objection whatever to running a lightning express over a 14 deg. curve if the exigencies of his background demand such a curve. An eastern road, a few years ago, advertised one of its fast trains on a poster, of gay colors, in which the signals were arranged so as to indicate that the train was backing (more truth than poetry, perhaps!). Literary fellers and artists are dangerous company at best. There is no doubt that they would unanimously prefer a flagman to a block signal, if they spoke from the heart; the flagman is so much more human.—EDITOR.]

THE EFFICIENCY OF RAILWAY EQUIPMENT.

CHICAGO, April 22, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have read with interest the editorial in the *Railway Age Gazette* of April 7, page 822, on "The Efficiency of Railway Equipment." In analyzing some of the figures given I do not get quite as much "inefficiency" as was shown. In the first table of statistics is an item "ten miles per pound freight locomotive tractive power per year," which was stated to have been based on the assumption that the tractive powers of freight and passenger locomotives were the same, for the reason that the Interstate Commerce Commission figures does not show them separately. If I follow the line of reason correctly, this item should be the quotient arising from dividing the "ton miles per freight locomotive per year" by the "average tractive power per freight locomotive" which gives me considerably different figures from those in the article. Below is a comparison of my figures with those of the *Railway Age Gazette:*

Ton miles per pound freight locomotive tractive power per year.		1907.		1909.	
	1902.		Per cent. decrease over 1902.		Per cent. decrease over 1902.
Railway Age Gazette figures...	357.6	298.9	18	245.5	31.3
Revised as above outlined.....	325.4	285.6	12.2	242.4	25.5

On the assumption that the figure for "passengers hauled one mile per pound passenger locomotive tractive power per year," is the quotient arising from a division of the item "passengers hauled one mile per passenger locomotive per year" by the "average tractive power of passenger locomotives," there is considerable difference between the results of my calculations and those of the *Railway Age Gazette,* and I give both sets of figures below:

Passengers hauled one mile per pound passenger locomotive tractive power per year.		1907.		1909.	
	1902.		Per cent. decrease over 1902.		Per cent. decrease over 1902.
Railway Age Gazette figures...	102.4	85	17	81.9	20
Revised as above outlined.....	93.1	83.8	10.9	82.2	11.8

There is no question about there being numerous difficulties in the way of arriving at a correct answer to the problem, which is all the more reason for its being attacked in a vigorous, persistent and consistent manner. There is, however, a question in my mind about the propriety of attempting to arrive at the efficiency of the railway equipment of the country as a whole from such limited and general data. It appeals to me that the term "utilization" more appropriately fits the case than the word "efficiency" and may possibly prevent a distorted view of the situation being taken by a layman, or one not desiring to see the matter in its true light. Undoubtedly a failure to make such a distinction in the past has resulted in erroneous deductions reflecting prejudicially on the railways.

With a view of ascertaining the comparative miles per locomotive per year and day, I have divided the "ton miles per freight locomotive per year" by the "average tons per train" and show below the results:

Year.	Average miles per locomotive. Per Year.	Per Day.	Per cent. decrease compared with 1902.
1902.....	22,486	62	..
1907.....	20,639	57	8
1909.....	17,783	49	21

Is it fair to the railways to consider "efficiency" as based on the "utilization" and of all the locomotives owned during an entire year, when it is well known that the volume of traffic to move varies widely; that a large percentage of the power is stored awaiting business from six to nine months of the year? The same statement, of course, applies to cars; and while there is no question that the figures show that the roads did not utilize the increased motive power or cars in the same proportion as their capacity increased, does this not reflect the fact that there are *too many cars and locomotives?* There certainly was no very great economic loss to shippers in 1909 by reason of failure on the part of the roads to move the tonnage offered; and at the same time, according to the American Railway Association's figures for the fiscal year ending June 30, 1909, there was an average daily surplus of freight cars amounting to 244,000, with a maximum at one time during the period of 340,000. At an average valuation of $1,000 per car this equals an investment of $244,000,000 practically standing idle for one year, the interest on which at 5 per cent. is $12,200,000. These cars require over 1,800 miles of track to store them and much of it is in large cities where terminal facilities are expensive. Yet did we not only a short time ago hear that there was a *car shortage,* and the railway commissioners were ordering the roads to increase their equipment? While I haven't the information as to the increased number of locomotives owned nor the surplus locomotive days, the decrease of 21 per cent. of miles per day in 1909 as compared with 1902 indicates to my mind that a considerable surplus existed. I doubt, however, if it was 21 per cent., for there were other factors in 1909 tending toward a reduction in the miles per locomotive per day.

From the above it will be seen that there is a number of factors which need to be *known* before judgment should be passed.

The factor of "increased tons per train" cannot be intelligently passed upon when compared with an increased "average tractive power" without taking into consideration the question of "balancing" traffic. If there is a material variation in the *volume of traffic moving in one direction* during the period to be compared, it will be quite apparent that full use of the pulling power of the locomotive can be obtained in but one direction, and this may easily bring down the general average although in *the direction of traffic* more nearly the theoretical rating may have been hauled.

To say that a decrease of 21 per cent. in "average miles per locomotive per day" reflects inefficiency is of course an easy way to dispose of the matter if one does not care to see the other side. In order to see the other side one must have a knowledge of how much of the power is stored, and held to protect prospective business; and how much longer it takes the mechanical department to make heavy repairs on a consolidation, Mallet or mikado engine than on the smaller type in use a few years ago, etc. What bearing has an increase of 20 per cent. freight and 14 per

cent. passenger *traffic density* on the ability promptly to move trains over single, or double, track? What bearing has the increase in tonnage of commodities moved at high speed on the *train mileage?*

Averages of performance during a given period means the equivalent use for every day during the period. If the business to move came to the railways uniformally each day, it wouldn't take them long to materially increase their dividends. But they must be prepared to take the business when offered regardless of the *economic necessities* for its prompt movement. Grain, cotton, etc., which are harvested once a year can be forced on the roads for movement in three or four months. The A. R. A. statistics of "tons moved one mile" for 1910 by months show a variation between the minimum and maximum of 22.8 per cent., while a representative trunk line in western territory showed a variation during the same period of 42.6 per cent.; and on some divisions of this road the variation was as high as 100 per cent. Of course to handle such a variable traffic, means a variable number of men; and where a force of trainmen, enginemen, yardmen, etc., is increased with men who know their services are temporary it is not surprising if the efficiency obtained from them was much less than the general average under normal conditions.

Such matters as these cannot be ignored in practice and ought not to be in discussions. Owing to the embryonic condition in which the fundamental operating statistics of the railways are and the complications and expense incident to their proper preparation, it is practically impossible for the railway manager of today definitely to place a cash equivalent opposite many of the items enumerated or prove to himself exactly what bearing they have on operation. At the same time, the practical and capable officer has intuition born of experience; and intuition is not altogether a bad thing to follow,—should it not at least have preference, in passing final judgment, until the prosecution shall have evidence enough to convict (or convince) him?

The measure of efficiency should only be applied during a time when there is a maximum demand for power and equipment, or else after deducting the surplus locomotives and cars during dull periods, data for which is probably not available. It seems to me the following points are the principal ones which need to be persistently followed up *in detail* to bring about a better and more economical use of equipment in general and more real efficiency during times of heavy traffic:

1. A record should be kept of the use obtained from locomotives and the service in which they have been engaged. This should account for each hour of the twenty-four, and should be not only on an engine, but also on a tractive power basis.

2. Thorough yard checks and more accurate car reports should be made.

3. There should be a higher grade of car distribution, and a continual checking of details.

4. A closer acquaintance should be formed between the operating officers and the shipping public in order that shippers may personally know some of the obstacles the operating department has to overcome, and *vice versa,* so that a better understanding be reached which cannot fail to increase efficiency and at the same time result in more satisfaction to shippers.

5. There should be a careful supervision and continual modification of merchandise and package car service, having in view not only good service as to time but the uses of proper cars, with a view of saving empty mileage and transfers; also, when empty cars are moving in the same direction that increased set-out cars are made, so as to save delays to local trains. This, of course, brings down the average "tons per loaded car" slightly, but on the whole increases efficiency.

6. Continual checking of empty car mileage should be done by classes and sub-divisions for cross-hauls.

7. Opportunities should be better availed for transfer of loads into equipment ordinarily moving empty one way, as stock cars, coal cars and refrigerator cars.

8. Increase minimums as far as practical according to the actual requirements of the traffic.

9. There should be gradual tightening of the rule for preventing detention of cars by shippers.

10. A more intimate knowledge should be acquired by the car distributors of "cost of transportation," that advantage may be taken of opportunities for short routing empty foreign or system cars via the line of lowest *real cost* instead of by routes that make excessive empty mileage producing an invisible, although real, increased cost.

N. D. BALLANTINE,
Superintendent Car Service, Rock Island Lines.

EFFICIENCY OF PUBLIC SERVICE OF AMERICAN RAILWAYS.*

BY JULIUS KRUTTSCHNITT,
Director of Maintenance and Operation, Union Pacific System and Southern Pacific Company.

A railway is a machine designed to manufacture freight and passenger transportation; it makes ton miles and passenger miles. How this machine does its work is a matter of great interest and great importance to the public, for the railway derives its franchise from, and renders its service to, the public.

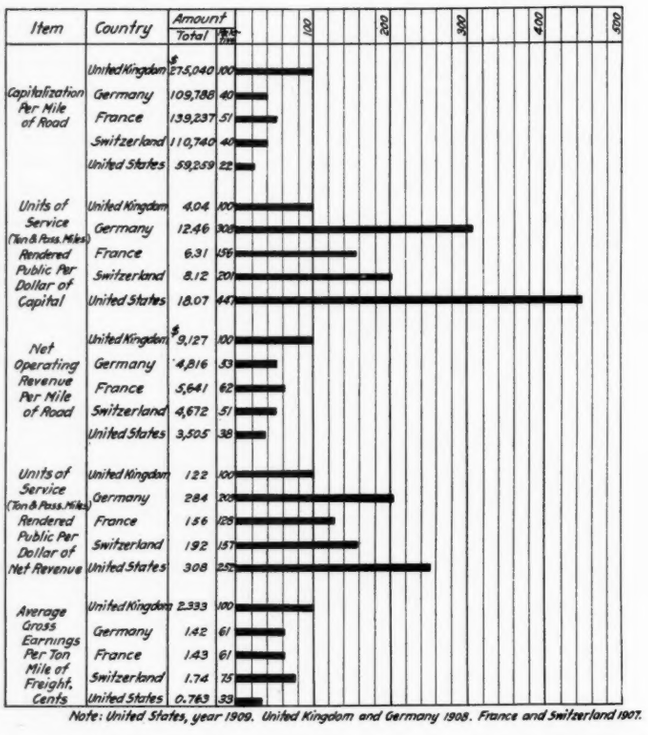


Chart A—Relative Efficiency of Capital and Public Service.

The unit of freight service is one ton hauled one mile; of passenger service, one passenger hauled one mile. The people are concerned in the quantity and quality of the ton and passenger miles that the machine produces; in the cost incurred in their production and in the prices, or rates, charged for them. They are concerned in the punctuality and safety of the transportation the railway furnishes and, indeed, in all those characteristics of its management and operation, which, taken together, make for efficiency or inefficiency.

The efficiency with which any one of our railways is, or all of them considered as a single system, are managed must be gauged by the results produced by the machine as a whole. Criticism has sometimes been made that parts of it are not efficiently operated. No railway man will deny that some parts of the transportation plant are not worked to their maximum possible capacity.

It can be shown, for example, that the average tractive power

*Abstract of a lecture delivered at Harvard University on April 26.

of locomotives and capacity of freight cars have increased faster than the amount of traffic which on the average is hauled per locomotive and per car. It can be shown that the amount of mail handled per postal car is much less than the average amount which each car is capable of transporting. It can be shown that the average number of passengers hauled per train is much less than the average passenger train can easily accommodate. But while it may easily be demonstrated that the maximum

TABLE 1.—CAPITALIZATION AND RESULTS OF OPERATION.

	United States. 1909.	United Kingdom. 1908.	Germany. 1908.	France. 1907.	Switzerland. 1907.
1. Capitalization per mile of road	$59,259	$275,040	$109,788	$139,237	$110,740
2. Units of frt. and pass. service per dollar of capital	18.07	4.04	12.46	6.31	8.12
3. Relative service per dollar of capital	447	100	308	156	201
4. Net operat. revenue per mile of road	$3,505	$9,127	$4,816	$5,641	$4,672
5. Ton miles freight per mile of road	953,986	529,622	827,400	496,939	442,012
6. Ton miles frt. per dollar net revenue	272	58	172	88	95
7. Passgrs. one mile per mile of road	127,299	580,044	540,045	380,355	456,654
8. Pass. & frt. units serv. per mile of road	1,081,285	1,109,666	1,367,445	877,294	898,666
9. Units of pass. and frt. serv. per dollar net revenue	308	122	284	156	192
10. Average earnings per passenger mile, cts.	1.928	1.542	0.93	1.54	1.30
11. Average earnings per ton mile, cts.	.763	2.333	1.42	1.43	1.74

AUTHORITIES: I. C. Statistics of Rys. of U. S., 1909; Report of British Board of Trade, 1908; Statistik der im Betriebe befindlichen Eisenbahnen Deutschlands, 1908; Statistical Abstract for Foreign Countries, issued by British Govt., March, 1910; Statistiques des Chemins de fer Suisses, 1907.

possible efficiency with which different parts of the railway plant might be operated under ideal conditions is not attained, it would be much harder to show that the maximum efficiency *practicable* under the conditions which actually exist, and with which the railway managers have to deal, is not approached. The railway manager has not, never has had, and never can have, the same degree of control over the operations of his plant and of each part of it that the manager of a mercantile or a manufacturing concern may exercise. Shippers demand, and properly, that freight shall be transported with regularity and expedition; and speedy and regular transportation are important elements in efficiency of operation. But it is often not practicable to move freight with the maximum speed and regularity, and at the same time hold cars and engines at terminals until the maximum car load and the maximum train load have

TABLE 2.—COMPARATIVE CAPITALIZATION AND SERVICE RENDERED THE PUBLIC, OF RAILWAYS OF UNITED STATES, YEARS 1889, 1899 AND 1909.

	Totals or Averages.			Relative.		
	1909	1899	1889	1909	1899	1889
1. Railway capital per mile of road	$59,259	$51,764	$48,028	123	108	100
2. Railway taxes per mile of road	$401	$245	$179	224	137	100
Certain facilities per 100 miles of road:						
3. Additional main track and sidings	45.43	33.32	27.37	166	122	100
4. Locomotives	24.30	19.39	18.93	128	102	100
5. Passenger cars	19.36	17.88	16.73	116	107	100
6. Freight cars	880.87	684.39	556.79	158	123	100
7. Operating expenses and taxes per $1,000 of capitalization.	$123.25	$104.50	$91.26	135	115	100
8. *Public service rendered (ton and passenger miles):*						
A—Per $1.00 of capitalization	18.07	14.25	10.89	166	131	100
B—Per $1.00 of earnings over exp. and taxes	348	337	274	127	123	100

been obtained. It would be easily possible for the railways to haul a much larger average load of mail per mail car, but under regulations of the postal department, postal cars are limited to a carrying capacity of only about three tons, whereas express cars can easily be loaded to the roof with twenty to thirty tons of express. Again, in the passenger service, the reason why the railways on the average haul only 54 passengers per train when the average train has a capacity of at least 150 passengers, is that the public demands, and properly, that it be given frequent and regular service, and frequent and regular service is incompatible with the maximum loading of trains.

The facts which I have cited illustrate one point which has been quite generally overlooked in discussions of railway efficiency. This is that efficiency from the standpoint of the railway manager often is not the same thing as efficiency from the standpoint of the public. Efficiency from the standpoint of the railway may consist in loading cards and trains to their capacity and moving only the minimum number of cars and trains necessary to handle the business. Efficiency from the manager's standpoint may involve a relatively slow movement of trains, because the faster engines are driven the greater the amount of fuel they consume and the smaller the load they can pull, the result being that the cost of running the train is increased, while the revenue derived from running it is reduced. On the other hand, as I have said, speedy, frequent and regular service is a very important factor in efficiency from the standpoint of the public. Now, when the public insists on a kind of transportation which is incompatible with the most economical operation, no one can justly criticise the railway managers for

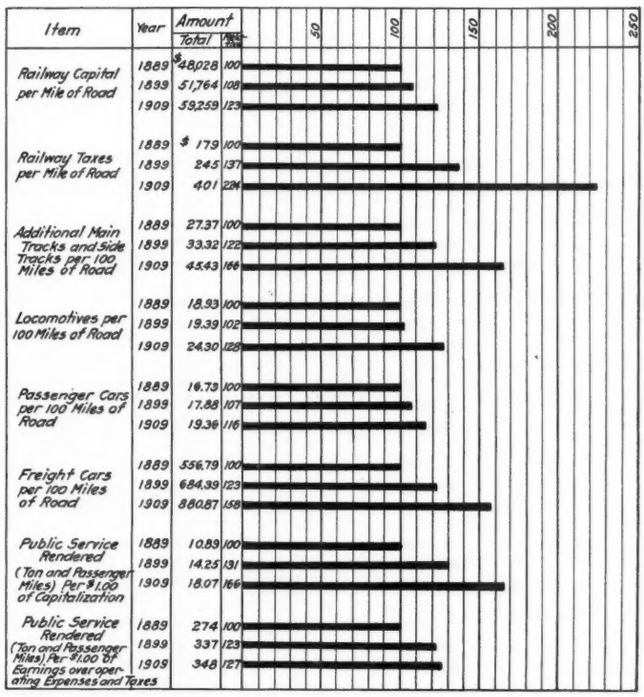


Chart B—Capitalization and Public Service of Railways of the United States.

complying with the public's demands and for that reason failing to operate the properties with the maximum possible economy. If the railway managers operates the properties, not with the maximum economy that might be possible under certain conceivable ideal conditions, but with the maximum economy that is practicable under the actual conditions with which they have to deal, they do all that they reasonably can be asked to do. I think that the railway managers of the United States are approximately much closer to the maximum *practicable* efficiency and economy of operation than most people believe.

The gentlemen whom I have the honor of addressing tonight will soon be actively participating in the public affairs of this country; many may become interested in railways and many may be occupying seats in state and national legislative bodies, in municipal, federal and state commissions, or even much higher offices, regulating the railways that their comrades have bought. It is important that such men should be properly informed regarding important questions affecting so great an industry as that of transportation. It shall be my endeavor, there-

fore, to demonstrate to you that the popular clamor about inefficiency in the management of our railways is unjustified; and by doing so to try to show you why you should bring the light of reason to bear on all questions pertaining to railways that may be presented to you in future, resisting temptation to tinker with or attempt to repair a piece of machinery until it is thoroughly understood, heeding the wise injunction that I remember as a child to have seen prominently displayed on French mechanical toys:

"Quoi qu'elle soit tres solidement monteé il ne faut pas brutaliser la machine."

THE EFFICIENCY OF CAPITAL INVESTED IN AMERICAN, AS COMPARED WITH FOREIGN RAILWAYS.

I have chosen for comparison with the railways of the United States, those of the United Kingdom, Germany, France and Switzerland. The railways of two of these countries, Germany and Switzerland, are in the main owned and operated by the governments; and those of the United Kingdom, which are privately owned, and of France, most of which are privately owned, would naturally be included in any comparison. One of the best tests of the efficiency with which any business is managed is the ratio between the capital invested in it and the results obtained with that capital. The capitalization per mile of the railways of the United Kingdom, Germany, France, Switzerland and the United States, and the relation between their capitalization and the results of their operation are shown in Table 1 and graphically in Chart A.

The capitalization per mile of the American roads is very much smaller than that of the roads in any of the other countries. This is very largely due to the conservative policy that has been followed by our railways of paying for many improvements, such as renewals with heavier rails and fastenings, larger cross ties, etc., out of earnings and charging them to operating expenses instead of to capital account.

The very large capitalization per mile of the British roads is to a great extent a result of following the opposite policy—that of charging all additions and improvements, no matter how small, to capital. The effect of this policy has been to embarrass the English railways seriously and even to raise grave fears as to their continued solvency.

As I have already said, the units of service rendered by the railway to the public are one ton hauled one mile and one passenger hauled one mile. It is for rendering these services that the public creates and pays the railway. Every dollar of capital which the owners of the railways of the United States have invested, renders four and a half times the service that the same dollar renders in the United Kingdom; one and a half times as much as in Germany; three times as much as in France, and two and a fourth times as much as in Switzerland.

It will be noted that the net operating revenues per mile of road—that is the net earnings or annual rental paid by the public for the hire of capital in the railways of the United States—are smaller than those of any of the other railways with which comparison is made. For every dollar of net earnings the railways of the United States rendered two and a half times as much service to the public as did the railways of the United Kingdom, and twice as much as did the railways of France. The Swiss and German railways are owned and operated by the governments, and yet for every dollar of net earnings the railways of the United States rendered from one and a fourth to one and a half times as much service to the public as did the railways of Switzerland and Germany. And they did so while charging the lowest average freight rates in the world. In other words, the owners of the railways of the United States received less profit in proportion to the amount of service that they rendered to their patrons than did the owners of any of the other railways, and the amounts that they charged shippers for rendering these services were smaller than the amounts charged the shippers by the railways of any of the other countries.

Let me try to indicate the results by another comparison. For the net amount earned on each dollar of capital the railways of the United States moved a passenger and about five and a half tons of freight one mile; those in the United Kingdom, a passenger and only .85 of a ton of freight, and those in Germany, a passenger and three tons of freight.

Because the owners of our roads received less in proportion to the services rendered by them than did the owners of any of the other railways, they might very well pronounce the management of their properties comparatively inefficient, but the users—the public—that received more services in proportion to what they paid than did the users of any foreign railways, have reason to consider the management highly efficient.

Table 3.—Fatalities on Railways of United States, Years 1889, 1899 and 1909.

	Averages.			Relative.		
Passengers Killed:	1909	1899	1889	1909	1899	1889
Due to collision or derailment	86	82	135	64	61	100
At stations, crossings, and other causes	163	157	175	93	90	100
Total	249	239	310	80	77	100
Passengers carried one mile	29,109,322,589	14,591,327,613	11,553,820,445	252	126	100
Passengers Killed per 100,000,000 Passenger Miles:						
By collision or derailment	0.30	0.56	1.17	26	48	100
By other causes	0.56	1.08	1.51	37	71	100
Total	0.86	1.64	2.68	32	61	100
Employees Killed:						
Due to collision or derailment	460	334	292	157	114	100
At stations, yards, and other causes	1,898	1,876	1,680	112	112	100
Total	2,358	2,210	1,972	120	112	100
Number of employees	1,502,823	928,924	704,743	213	132	100
Employees Killed per 1,000 Employees:						
By collision or derailment	0.31	0.36	0.41	76	88	100
By other causes	1.25	2.02	2.39	53	85	100
Total	1.57	2.38	2.80	56	85	100
Trespassers and Others Killed:						
Due to collision or derailment	76	63	66	115	95	100
Struck by trains and other causes	5,737	4,611	3,475	165	133	100
Total	5,813	4,674	3,541	164	132	100
Total train mileage	1,112,452,351	862,258,714	660,441,377	168	131	100
Trespassers killed per 1,000,000 train miles	5.23	5.42	5.36	98	101	100
Total deaths incident to train movement	8,420	7,123	5,823	145	122	100
Deaths not incident to train movement	302	Not reported		...	...	...
Total shown by I. C. C. reports	8,722	7,123	5,823	...	...	...

Note.—Excludes accidents due to causes other than those resulting from movement of trains or cars, also accidents to trespassers and persons other than passengers and employees.

INCREASE OF EFFICIENCY OF RAILWAYS IN TWENTY YEARS.

Let us now turn from comparison of the efficiency of our own with foreign railways to a comparison of the present with

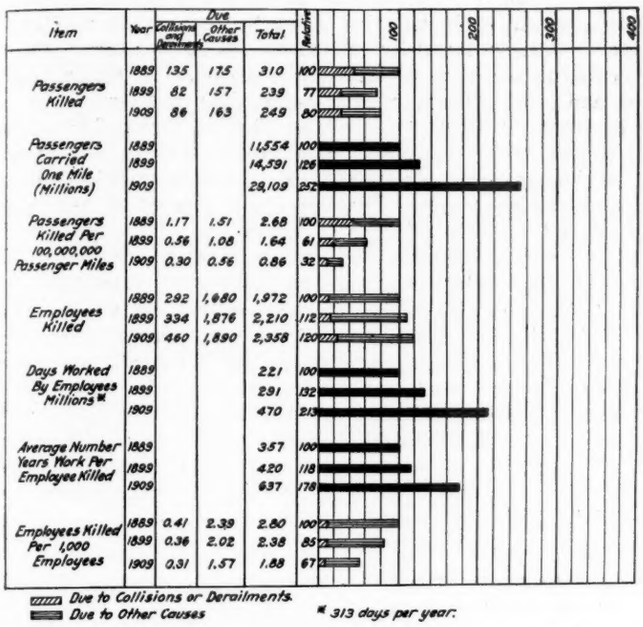
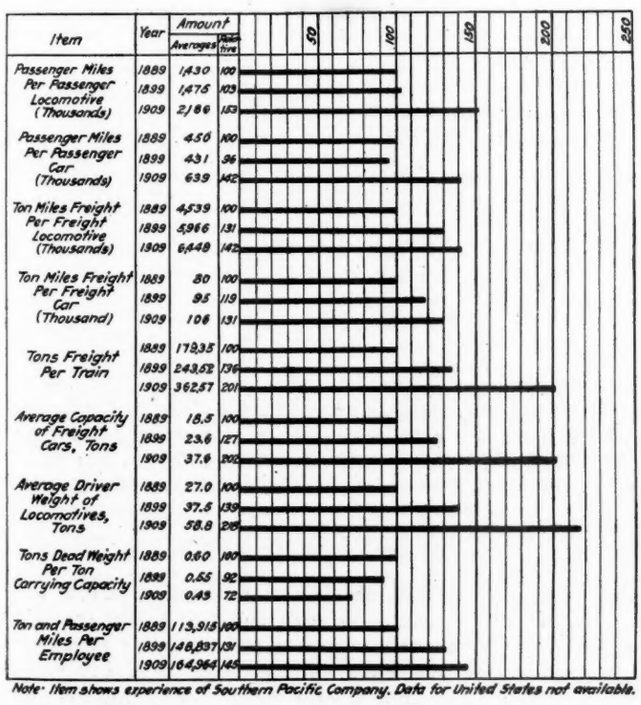


Chart C—Fatalities to Passengers and Employees on Railways in the United States.

The figures given in the chart for employees killed per 1,000 *employees for* 1909 *should read:* 0.31—1.26—1.57—56, *conforming to those given in Table* 3.

the past efficiency of our railways. Chart B and Table 2 show the increases from 1889 to 1899, and then to 1909, in the capitali-



Note: Item shows experience of Southern Pacific Company. Data for United States not available.

Chart D—Efficiency Per Unit of Men and Transportation Vehicles, on Railways in the United States.

zation of our railways, in taxes paid by them, in their sidings and additional main tracks, and in locomotives, passenger and freight cars, and also the increase between these years in the public service rendered per dollar of capital and per dollar of earnings over expenses.

It is a very remarkable fact that the increase in capitalization in twenty years was only $11,200 per mile, or 23 per cent. The cost of additional side tracks and equipment would easily cover $7,000 per mile of this increase. This leaves but $4,200 to represent the very large sums spent principally in the last ten or twelve years in the practical reconstruction of many important railways, which involved extensive reductions of grades and rectifications of curves; the building of additional expensive stations and terminals; the ballasting and tie-plating of tracks; the laying of heavier rails and ties; the construction of heavier bridges; the installation of interlocking and signalling systems; the replacement of perishable wooden by permanent structures using cement, masonry and steel; and the accomplishment of numerous other betterments. These improvements represent an average expenditure of very much more than $4,200 per mile, and that the increase in capitalization has been so small has been due to the fact that, as previously stated, much of the expenditure for them has been out of earnings and has not been capitalized. It is not represented by securities at all, but it is very clearly reflected in the more substantial character of the property and in a very large increase in its value.

The American practice of investing large amounts of earnings in improvements, together with the rapid rise in property values caused by the development of our country, has made the actual physical value of our railways much larger at the present time than their capitalization, regardless of "stock water-

TABLE 4.—EFFICIENCY PER UNIT OF MEN AND TRANSPORTATION VEHICLES; RAILWAYS OF UNITED STATES.

	Averages.			Relative.		
	1909	1899	1889	1909	1899	1889
1. Pass. miles per pass. locomotive	2,185,877	1,474,765	1,430,105	153	103	100
2. Pass. miles per pass. car..	638,586	431,059	450,178	142	96	100
3. Ton miles frt. per frt. locomotive	6,447,708	5,966,193	4,538,786	142	131	100
4. Ton miles frt. per frt. car	105,518	95,458	80,473	131	119	100
5. Tons freight per train....	362.57	243.52	179.35	201	136	100
6. Average capacity of frt. cars, tons	37.6	23.6	18.5	202	127	100
7. Average driver weight of locomotives, tons	58.8	37.5	27.0	218	139	100
8. Tons dead weight per ton carrying capacity	.43	.55	.60	72	92	100
9. Ton and passenger miles per employee	164,964	148,837	113,915	145	131	100
Ton and passenger miles per employee:						
10. United Kingdom—1907...	42.155					
11. Germany ....—1908...	69,546					

NOTE.—Items 6, 7 and 8 show experience of Southern Pacific Co.—data for United States not available.

ing" that may have been done in the past. In several instances, notably in the states of Minnesota and Washington, valuations of railway properties made by public commissions have exceeded the total capitalizations of the roads included. The boards of assessors in many states have made official records of their opinion that the increase in the value of the railways of the United States during the last two decades has been greater than the increase in their capitalization. The capitalization per mile increased from $48,028 in 1889 to $59,259 in 1909, or 23 per cent. Meantime the taxes which the railways were obliged to pay increased from $179 to $401 per mile of road, two and a half times as much, or 124 per cent. Assume, for the purpose of this discussion, that one-third of the capital of $48,000 in 1889 was fictitious or "water," the real value was only $32,000 per mile. An increase of 124 per cent. in that amount makes $72,000 per mile, which we may take as the estimate of the public through its taxing authorities of the present value of our railways, as compared with their actual capitalization of only $59,259 per mile.

While capitalization per mile has increased only 23 per cent. and taxes per mile have increased 124 per cent., the intensive development of the properties has been so carried forward that the increase in the mileage of additional main and side tracks has been 66 per cent., the increase in the number of locomotives 28 per cent., in passenger cars 16 per cent., and in

freight cars 58 per cent. This takes no account of the great enlargement of the capacity of equipment, which was proportionately in excess of the increase in its amount. In consequence of the improvements indicated by these figures, the railways were enabled to so increase their efficiency that at the end of the twenty years' period they rendered 66 per cent. more public service for each dollar of their capitalization than they did at its beginning. In spite of a 35 per cent. increase in the operating expenses and taxes per dollar of capital they rendered in 1909 27 per cent. more service per dollar of earnings over operating expenses than they did in 1889. The extent to which their efficiency was increased will be much better understood if it be considered that during this period the wages of all kinds of labor and the prices of most commodities were increasing while the rates received by the railways decreased. Quantities of labor and commodities which in 1890 could be bought in exchange with one ton mile, required for their purchase 1.60 and 1.43 ton miles respectively in 1907. Of course, the obvious tendency of these reductions in rates and these increases in prices of labor and commodities was to enhance the difficulty of rendering a given amount of public service with a given amount of capital. It would seem that the foregoing figures demonstrate conclusively that on the average each dollar of capital invested in railways has been progressively made much more productive and much more efficient during this twenty years.

THE ACCIDENT RECORD OF AMERICAN RAILWAYS.

Contrary to general belief, great progress has been made by the American roads within the last two decades in making transportation safer, and this has been done notwithstanding the number and speed of fast passenger trains, to which most of the fatal accidents are attributable, have been increased; that the density of traffic has been largely augmented, and that the rapid growth of business has made necessary the employment of numerous inexperienced men, and the promotion to responsible positions in train service of others with less experience than would ordinarily be put in such service.

Owing to acts of Congress requiring reports of individual casualties the statistics of the Interstate Commerce Commission regarding them are, for recent years, extremely complete. They were much less complete in earlier years, as then the carriers had to make only annual reports, and there is no question that many minor injuries now reported under the head of "persons injured" escaped notice and were not included in the earlier reports. The ratio of injuries to fatalities reported in 1889 was 4.5; in 1899, 6.2; and in 1909 nearly 11. It is fair to assume that the ratio between injuries and fatalities remains reasonably constant, and the fact that the ratio between those reported have not remained constant, justifies the belief that in the earlier years a smaller proportion of injuries was reported than is now the case. I believe, therefore, that the only way to arrive at a correct conclusion as to the relative safety of travel at present and in past years, is to ignore the statistics as to injuries and to make comparisons only between the number of fatalities, every one of which necessarily has been reported.

Table 3 and Chart C show that both travel and employment on the railways of the United States are much safer than is popularly supposed. The statistics indicating the ratio of passengers killed to passengers hauled one mile, demonstrates that on the average in 1909 a passenger could travel 4,000 times the distance around the earth without being killed, or to state the matter in another way, he could ride at the rate of 60 miles an hour for 220 years without having a fatal accident. Similarly the figures giving the ratio of the number of employees in service to the number killed show that on the average an employee could work for 637 years before being killed.

As we must all rely on the statistical reports of the Interstate Commerce Commission for our information about the results of operation of the railways as a whole, I wish to call attention to the fact that the comparative summary of railway accidents on page 86 of the commission's statistics for 1909 is misleading. It is apt to cause the conclusion not only that a great number of persons are hurt on railways, but that there has been a large increase in the number. The number of casualties in 1899 is given as 5,282, and in 1909 as 8,722, an increase of 3,440. But a reference to the report for 1899 will show that in that year no casualties due to such causes as handling freight at stations, accidents in shops, etc., were included. These figures are included in the report for 1909, which accounts for 302 of the increase in deaths. Again, 2,318 of the increase in deaths were those of trespassers and other persons, leaving a net increase of only 820 in passengers and employees killed, or 36 per cent. Meantime, there was an increase of 113 per cent. in the number of employees, and of 152 per cent. in the volume of passenger traffic, which shows that proportionately there was a reduction and not an increase in accidents.

Guided by the light of statistics all the dark holes and corners of American railway operation have been explored; the life of timber in cross ties and trestles has been increased from two to four fold; equipment has been improved in design and wonderfully increased in capacity; new locomotive designs to burn the lowest grades of cheap fuels have been perfected; hot boxes so annoying and productive of delays in past years have been reduced so that they are practically a thing of the past; the wasteful haul of empty cars has been largely reduced by pooling freight equipment.

INCREASED EFFICIENCY PER EMPLOYEE AND MACHINE.

Table 4 and Chart D herewith, show the extent to which by means of more efficient methods the work done by each locomotive and car owned, and by each employee, as measured by the ton miles and passenger miles handled per employee per car and per locomotive, has been increased since twenty years ago. The efficiency per passenger locomotive has been increased 53 per cent.; per passenger car, 42 per cent.; per freight locomotive, 42 per cent.; per freight car, 31 per cent.; and per employee, 45 per cent. These results have been achieved in spite of the fact that conditions of employment have become more favorable to the employee so that he works less hours per day for a month's salary and runs less miles in train and engine service in doing a month's work.

I have incidentally referred to reductions of grades and curvature involved in rebuilding many miles of our railways. A typical piece of reconstruction on the line of the Southern Pacific, was the Lucin Cut-Off, in Utah, which shows strikingly how the efficiency of motive power is increased through modernizing the permanent way. By the construction of that cut-off, the hauling power of a consolidation locomotive used on that part of the system was increased 148 per cent.

In the general reconstruction of the Union Pacific and Southern Pacific in the states of Wyoming, Utah and Nevada, 19,742 degs. of curvature, or 55 complete circles, were eliminated. The maximum grades were reduced from approximately 100 ft. to the mile to 43 ft. to the mile on the Union Pacific, and 21 ft. on the Southern Pacific, and the line between Cheyenne and Reno was shortened 82 miles. In doing this 484 miles of new railway were constructed, or almost enough to reach from Boston to Buffalo.

Chart E shows the following:

1. The trend of labor and commodity prices for fifteen years from 1894 (the year following the panic of 1893), to 1909, based on data taken from bulletins 77 and 87 of the United States Bureau of Labor. As these bulletins do not contain data as to prices for labor subsequent to 1907, we have assumed that these prices did not increase in 1908 and 1909, an assumption known to be incorrect, but which we make, as its effect is unfavorable to our exhibit.

2. The rates per passenger mile and per ton mile actually received by the railways and *estimates* of what these rates *would have been* had they followed the trend of labor and commodity prices.

Do you fully appreciate what the present average rates of

1.92 cents per passenger and 0.76 cents per ton mile mean? The former is a little less than the value of a two-cent postage stamp, yet for the cost of this small stamp the railway transports a passenger and his luggage one mile, and in addition, 3,600 lbs. of vehicle to seat him, 650 lbs. of vehicle for his luggage, and 2,000 lbs. of sleeping, dining and parlor equipment for increasing his comfort. For the same tiny stamp the railway carries 2¾ tons of freight one mile for the shipper, and provides and hauls on its passenger trains for the Post Office Department the equivalent of a fully-equipped post office on wheels weighing 45 to 50 tons a distance of about ¾ of a mile.

The ordinates intercepted between full and dotted lines in the lower diagrams give the savings per passenger and per ton mile accruing to the public from the action of forces that prevented rates from following the trend of prices. The most potent were, (a) Reduction in cost resulting from larger increase in volume of business and, (b) More efficient operation made possible by reducing curves and grades, adopting larger, heavier and better designed locomotives and freight equipment; building more main tracks, side tracks, yards and terminals; adopting more refined methods of operation, such as carefully rating locomotives, running them at most economical speeds for

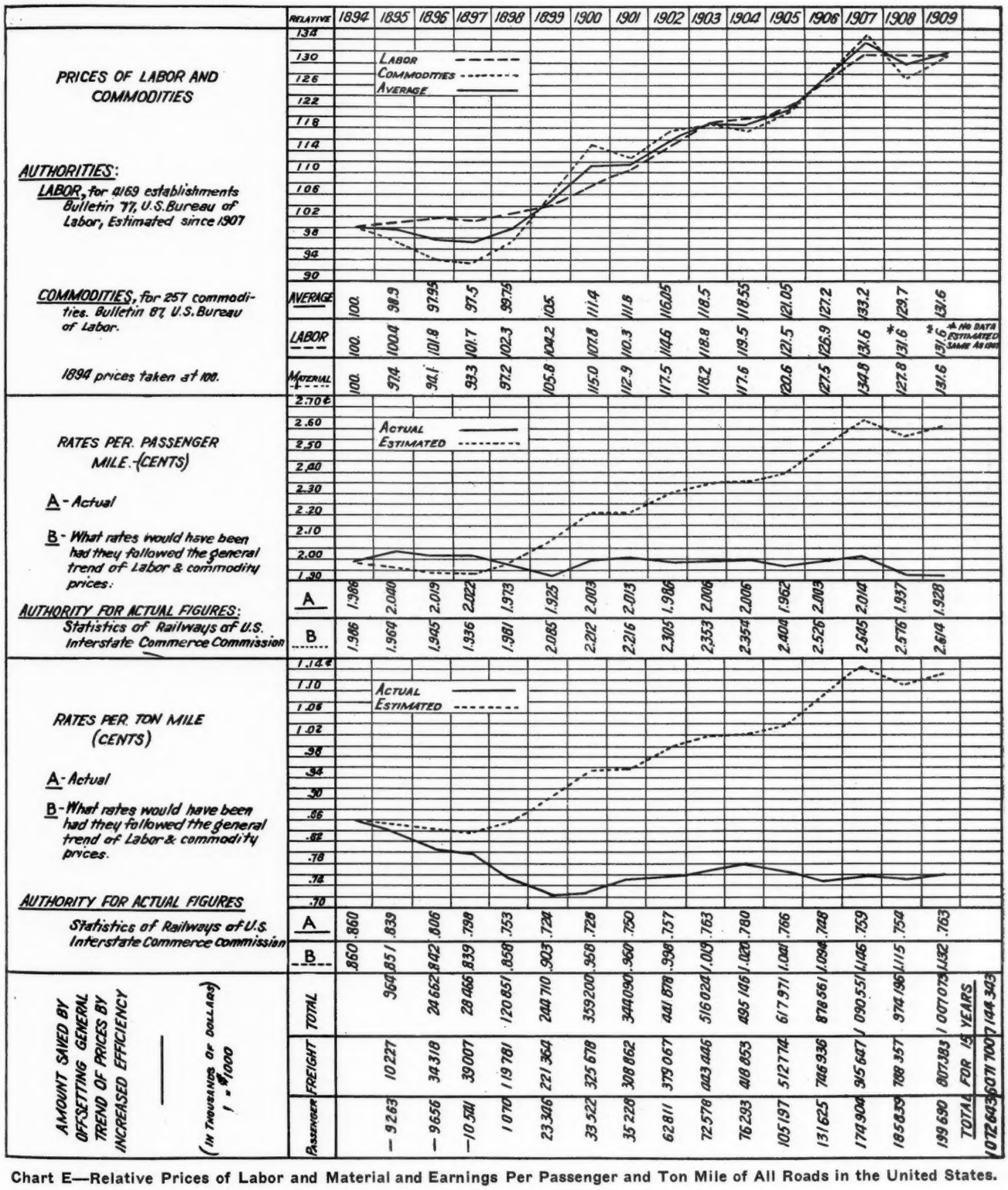


Chart E—Relative Prices of Labor and Material and Earnings Per Passenger and Ton Mile of All Roads in the United States.

freight trains, eliminating delays to men, motive power and equipment, etc.

Multiplying the saving in rate for each year by the passenger and ton mileage, and adding the products, shows that in the fifteen years $7,144,343,000 was saved to the public in transportation charges. Some conception of this amount may be formed by considering that it means an average saving per day over the entire period of a little over $1,300,000, and that for the year 1909 it means a saving to the public of $2,760,000 every twenty-four hours.

BRIDGE REPLACEMENT ON THE BOSTON & ALBANY.

The increase in the weight of cars and locomotives has made it necessary to renew a number of bridges on the Boston & Albany during the past year. In all, 19 bridges have been replaced, their spans running from 38 ft. to 114 ft., and the work contemplated involves renewing 40 more. The method of doing the work has been to erect the new bridge alongside the old, couple the two together, set them on a nest of rollers, and when the rails and ground connections are broken, draw the old out and the new into place at once.

The time occupied in the actual moving has varied from 35 to 50 seconds, most of them being between 40 and 50 seconds. The time between the last train over the old structure and the first one over the new has varied from 1½ to 2 hours, while the time from the start of breaking the rails until the connecting rail is down and ready to take a train runs from 1 to 2 hours, with an average of about 1¼ hours. In all of the work, however, it has not been found to be necessary to flag a single train, though, of course, a slow order is kept in force from the time work begins on the disturbance of the old bridge until all work is done on the new and the approaches are adjusted and settled.

The last bridge replaced was a three-span, through-truss bridge over the Westfield river at Huntington, Mass., the work being done on Sunday morning, April 9. The lengths of the three spans were 80 ft., 103 ft. and 80 ft. respectively. The new bridge is of the through plate-girder type and is composed of three spans of the same lengths as the old ones. The general details of the bridges are shown in the accompanying table.

The old truss spans were of the usual lattice type, with chords and end posts of box sections latticed on the open sides. This bridge was built in 1875 and was reinforced in 1894.

The new bridge is a heavy plate girder structure, with 8 in. x 8 in. x 1 in. flange angles and side plates for reinforcing the web, as well as partially serving as flange sections. This steel work was built under the 1910 specifications, and to Cooper's E-60 loading.

The floor system is continuous, with an anchorage of the spans on one pier only. The girders expand on the abutment immediately adjacent to that pier, and in the other direction continuously over the adjacent pier and on the farther abutment. Expansion pockets are used merely for convenience during erection and for preventing any consecutive thrusts from the track being transferred to adjacent spans.

Bridges Replaced on the Boston & Albany, 1910-1911.

Bridge No.	Location.	Length.
70	Rochdale	114 ft.
81	West Brookfield	113 ft.
92	West Brimfield	93 ft.
125 (3 spans)	Huntington	295 ft., in progress
126 (3 ")	Huntington	263 ft.
129 (2 ")	Chester	190 ft.
132 (2 ")	Chester	194 ft.
133	Chester	109 ft.
145	Middlefield	80 ft.
147	Becket	108 ft.
148	Becket	98 ft.
149	Becket	106 ft.
167-A	Pittsfield	47 ft.
172	Pittsfield	38 ft.
173 (2 spans)	Pittsfield	100 ft.
201	Chatham, N. Y.	70 ft.
202	Chatham, N. Y.	105 ft.
203	Chatham, N. Y.	71 ft.
209 (2 spans)	Chatham, N. Y.	148 ft.
222	Rensselaer, N. Y.	55 ft.

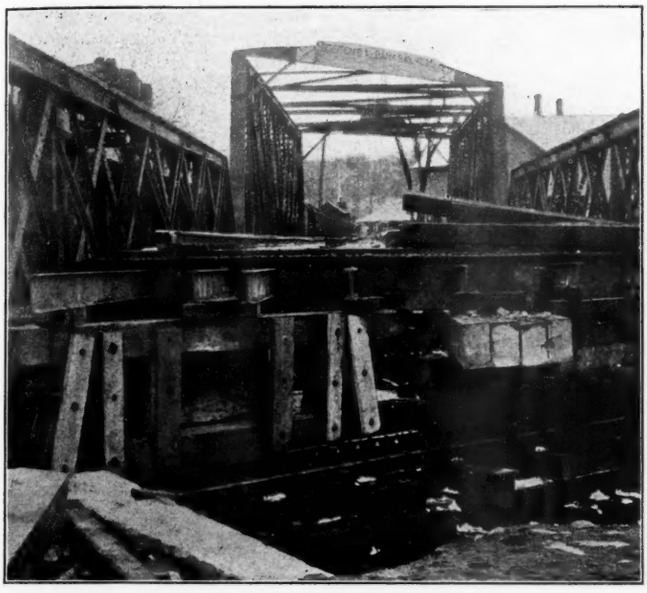
Note.—Total length of *single* track on bridges replaced aggregates about one mile.

Bridges Before Being Moved.

The method of construction and replacement is an exceedingly simple one in outline, but one that involves a great amount of detail and the closest attention to adjustment. In the case at Huntington, matters were somewhat complicated by the fact that it is a skew bridge, with rails crossing it on a 1 deg. 33 min. curve, and that on the down-stream side there was a large elm tree which the village authorities would not allow to be cut down. Just beyond this there was a highway bridge that could not be disturbed. On the up-stream side there was plenty of room for erecting the new bridge.

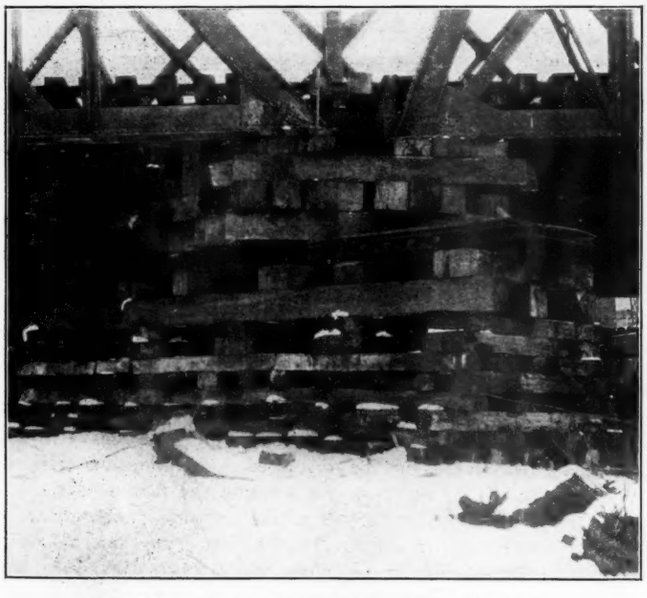
The illustrations will give a fair idea of the location and general methods involved. In the first place the old bridge had to be carried by blocking, while new piers were being built below it. This necessitated raising the whole structure about 12 in. to give the necessary clearance and to permit placing the train of rolls that was to carry it out of the way. As the work has been done during the past few months, it involved the usual protection against high water, ice and drift. After the completion of the masonry the new bridge was erected on trestles that extended about 45 ft. up stream from the

old structure. This was just beyond the up-stream girder of the new bridge as it was erected. The trestles are of short vertical posts, set on sills laid in the bed of the stream, with caps and cross ties to carry the runway for the rest of the



End View of Old Bridge, After Moving.

rollers. These runways were formed of nine 90-lb. rails nested as shown in the photograph. They were laid on a very easy incline, so as to facilitate the movement of the bridge, and with a slight adverse incline like a gentle kick-back at the lower end so as to check the motion of the bridge. They were carefully wedged and brought to a true alinement, so that they presented a smooth bearing for the rollers over the whole width. The rollers were 2 in. in diameter, and were spaced about 24 in. apart. They were 36 in. long, and were held in position by spacing bars or angle racks drilled to set over

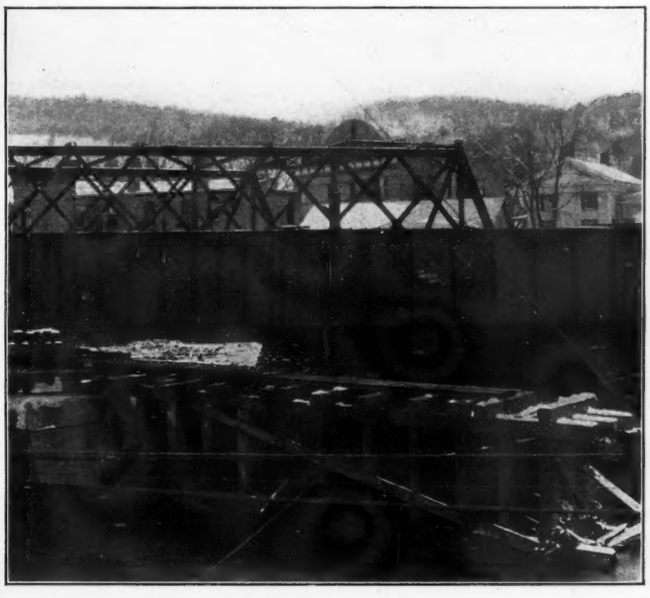


Blocking Under Old Bridge, After Moving.

the ends of the rollers outside the runway and the runners on the bridge. The runners were also made of rails, but were not nested. They were set side by side, flange down; seven were used in each runner, so that it was somewhat narrower than the runway. The bridges were set on these runners through blocking and wedging that kept them at the proper height.

At the ends of the old bridge a good deal of temporary blocking had to be used in order to facilitate the clearing away on the morning of the movement. The obstructions on the down-stream side at one end necessitated the complete cutting away of the truss and carrying it by temporary blocking and falsework. The end was simply cut off and a wooden post with tie bolts inserted; in this condition it carried its load for some time. The cutting was done with the oxy-acetylene flame, which is used by the contractors in all of their work of demolition. If a girder is to be cut the flame does it. If a pin cannot be driven out the piece is cut away around it and taken out with the pin. If rivets are in an awkward position to be cut, no time is spent in attempting to cut with a chisel; the oxy-acetylene does the work.

At the ends of the bridge it was impossible to put in the walls and back filling until the new bridge was in place. As soon, then, as the last train had passed, the connecting rails were removed, the blocking torn out and everything cleared so that there was a space of about 15 ft. between the ends



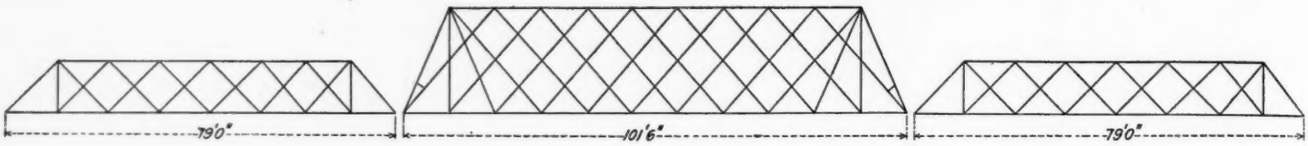
False Work on Which New Bridge Was Erected.

of the bridge and the banks, due to removing the skew end stringers. As soon as this was done the signals were given and the bridge moved. The time occupied in the movement was 49.2 seconds.

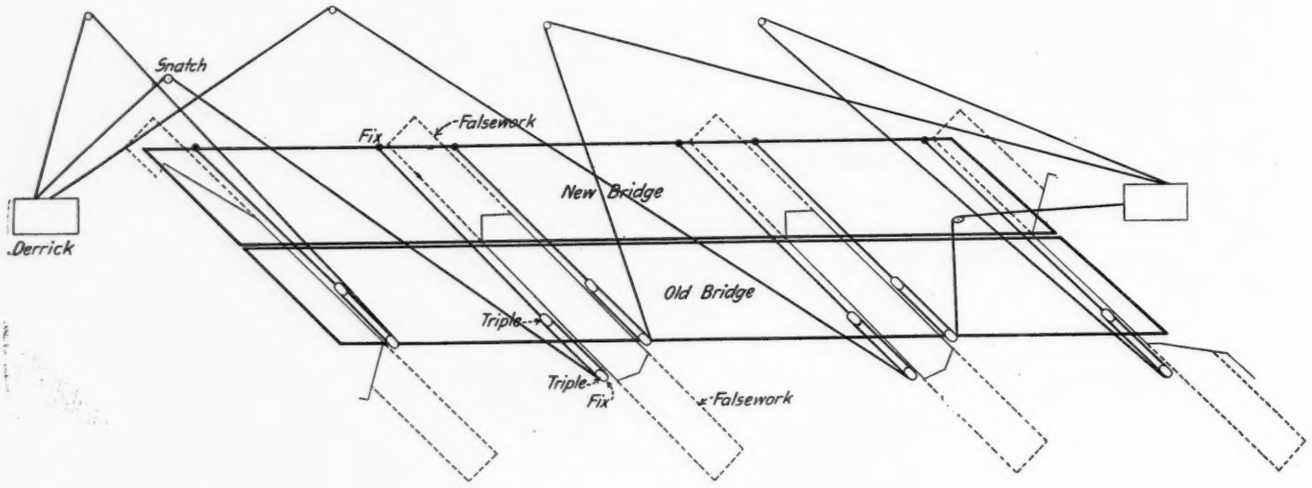
It was moved by six leads running out to three drums on each of two derrick cars stationed on either bank. The method of reeving the lines is shown in the accompanying sketch. There was a triple block and fall on each lead from the up-stream side of the new bridge, the steel rope being led around a snatch block to the winding drum on the car. The purchase was thus raised to 6 to 1, enough to permit of slight variations in winding speeds without it being perceptible on the moving structure. When all was ready, the erecting foreman, H. D. Mason, under whose supervision and control the work was done, took a position at the center of the bridge, with an assistant at each end. Hand signals were used, and these were so complete and clearly understood that there was no perceptible difference in the time of starting or stopping at the two ends, while the movement was gentle and steady throughout. Standing on the bridge there was no jerk or jar from start to finish, and it was difficult to realize what had been done. The movement started smoothly and accelerated for about 5 seconds; then there was a steady motion for about 40

seconds, and finally a gradual slowing down to the stop at 49.2 seconds.

The smoothness and success of the performance was of course due to the care and foresight that had been exercised in the preparation. For a week before the movement the engineers had been busy in checking the levels and the alinement. The levels of the runways had been repeatedly taken and their alinement had been checked and cross-checked until every possibility of an error had been eliminated.



Old Truss Bridge.



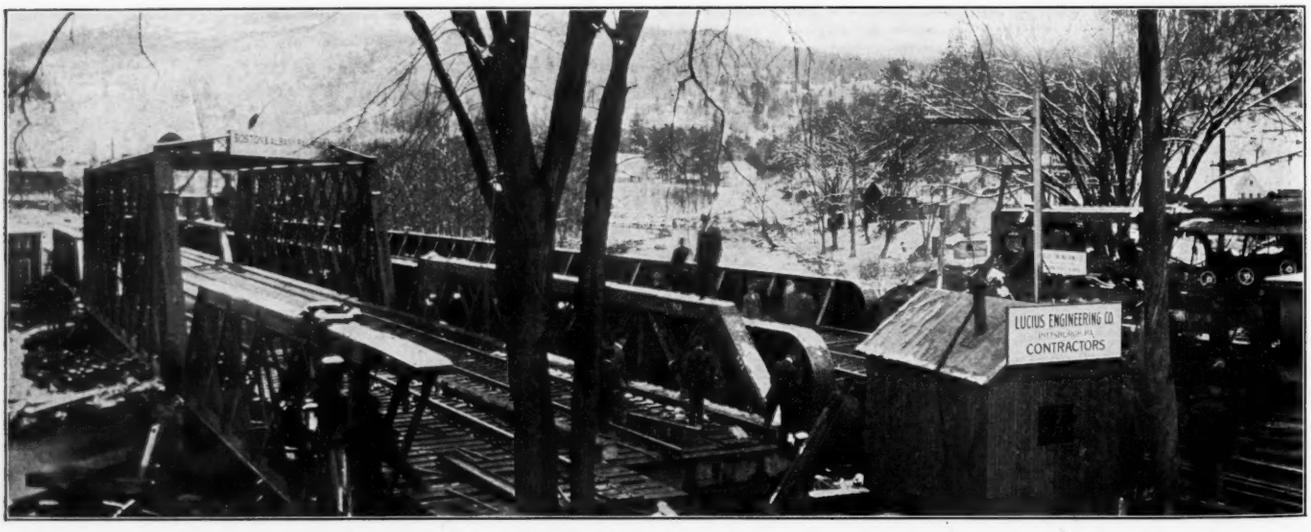
Arrangement of Tackle.

This sketch is not drawn to scale, and the positions of the snatch blocks are not accurate.

The moment the bridge was in position there was a display of team work on the part of the several departments interested that spoke more volumes for the general efficiency of railway operation than their critics could utter on the other side in weeks. The floor, the ties and the rails on the bridge were in place. The rails were plated and loosely spiked, but not bonded. They were laid so as to be approximately in place to admit of the dropping in of a single rail between their ends and the rails on land. The gap to be spanned was about 15 ft.

A trestle bent had been left in against the bank, the top of whose cap was level with the top of the adjacent pier. The moment the bridge stopped a gang of men started to place the stringers across from the bent to the pier. Main ties were laid on these and they were blocked to take the cross-ties. At the same time a section foreman commenced leveling the back fill and driving back the bridge rails to permit the connecting rail to be dropped into place. The moment it could be slipped in, it was placed, the ties were slipped beneath it and tamped up to surface. Then the permanent spiking of the bridge rails was done. At the same time the signal forces were at work with the bonding. The holes were drilled and the bonds riveted home. It would be difficult to say as to which finished first, but at any rate the bridge was ready for a train full 20 minutes before the first one presented itself for passage.

A noticeable feature of the performance was the alacrity



New Bridge in Position.

with which the men sprang to their work, apparently sharing in the anxiety of the foremen to maintain the record of not flagging a train. The efficiency of the organization was also shown by the smoothness with which the work progressed. There were no false moves. Every stringer dropped into its place and fitted there, the bents and masonry needed no shimming, ties and plates and bonds were at hand, every shovelful of dirt went to its appointed place and remained there, and there was no scarcity of cinder to raise the rails. Each man had his place and filled it without interfering with others, and though they seemed packed like sardines about the bridge ends there were no cross currents or counter-movements. They acted like well-drilled veterans for the work in hand.

The schedule of the performance was as follows:

Last train over old bridge	9:35 a. m.
Bridge started to move	10:18 a. m.
Time of moving bridge	49.2 seconds
First track completed	11:15 a. m.
Second track completed	12:00 m.

No trains flagged.

The general design of the new bridge came from the railway company and was executed by the American Bridge Company. The plan for erection and replacement, as given in the first few lines of this article, together with the execution of the details, was handled by the Lucius Engineering Company, Pittsburgh, Pa., under the approval of the railway's engineering department. The railway staff which directed the entire work consisted of F. B. Freeman, chief engineer; W. F. Steffens, engineer of structures; and W. B. Knight, division engineer. The details were worked out in the field by the Lucius Engineering Company, and especially by their foreman of erection, H. D. Mason.

SOME SUGGESTIONS FOR INCREASING EFFICIENCY.

BY N. F. DOUGHERTY,
Yardmaster, Pennsylvania Railroad.

In this country generally the railways have reached the end of their construction period. Today the problem is how these great commercial factors may be maintained and operated so as to give to the public efficient transportation service, and to their owners a fair profit on their investment. The solution is, first, in better organization; and, secondly, as in any other business, in a low cost of production.

Under the present scheme of organization there is no adequate system. This is apparent in the absence of direct control of operations. Before a plan can be executed it must pass through various so-called departments, many of which are not concerned, and by the time it reaches the place of execution the emergency or necessity for which it was evolved has passed, or else the plan has become so encumbered with suggestions as to be impracticable. For instance, the president will issue an order to a vice-president, who, in turn, issues it to the general manager, thence to a general superintendent of transportation, thence to a superintendent of transportation, thence to a general superintendent, thence to a chief car distributor, thence to a division superintendent, thence to a trainmaster, thence to a yardmaster, at last reaching the person who is to execute it, a conductor. By that time there is nothing to be done—the emergency has passed, or, as is usually the case, has taken care of itself.

The field of railway operation is so vast that to secure direct control requires unit control; in other words, divisional responsibility. The important point on a railway is the yard, for it is there that congestion of traffic begins which in a short time works back and results in road congestion. In nearly every instance the cause may be traced to want of authority in the yardmaster to control the operations of the roundhouse, car inspection, track and clerical forces, all of which in the complex organization of railways have a certain bearing on operation. Therefore, by increasing the scope of authority of the yardmaster, and making that position directly responsible to the division superintendent, the first step in the avoidance of congestion in the movement of cars is secured. Let the trainmaster control road operation only. The divisional unit should be next. As the trainmaster and yardmaster units would give "on the ground" supervision, divisions could be enlarged, which would mean a decreased operating cost.

It may be well here to explain how the giving of additional authority to yardmasters will result in a benefit to the operation of a railway. Cars cannot be moved without locomotives; and the yardmaster is at the mercy of the roundhouse foreman, unless he has authority to control the work of the roundhouse in so far as the matter of getting locomotives in and out of the house is concerned; and he is at the mercy of the car inspectors unless he can control their operations. The same is true of the track and clerical forces.

The plan suggested is simply the concentration of authority and responsibility in the yardmaster as far as the movement of cars is concerned. It contemplates individual responsibility, and, all officers being active men, abolishing many intermediate offices. Yards are the pivotal points of divisions; and as yardmasters, under this plan, are to be men with authority and power and not members of committees or correspondence clerks, their position must rank with that of the trainmaster.

So much for the staff. Now as to the organization below the offices of trainmaster and yardmaster:

The theory of a railway organization is sometimes compared to that of a standing army. But the fault is that the comparison has been made to an army in peace, whereas the comparison should be made to an army in action. Railways are always "fighting" to move cars; there is no time of peace, for peace to a railway means insolvency.

That the plan of army organization may be applied to railway employees is true; but, admitting that it is the trained and well-equipped army that gets results, at the same time it must not be overlooked that the strength of an army is in the ranks, and that a soldier fighting for his country is also fighting for himself. In other words, it is individuality that prompts men to action.

Now, under the present plan of railway organization and management, employees below the staff are divided into classes; a clerk is a clerk, a brakeman a brakeman, a conductor a conductor, an engineman an engineman, and, as a rule, they generally so remain. But with an army in action a private today may be a corporal tomorrow, and often before war is terminated he becomes a member of the staff, and any private may look forward to distinction of some kind; in other words, an efficient army is simply the effect of merit rewarded.

To apply the plan of army organization to railways the employees must be given an opportunity to advance in the service by—

(1) A system of promotion based on merit, as outlined in an article by the author published in the *Railway Age Gazette,* July 22, 1910.

(2) Graduated wage promotion, which means a decreased cost of production.

A further evidence of lack of system on railways is the haphazard method of compensating labor. The plan of graduated wage promotion would secure a uniform and equitable system of compensating labor, and ultimately a reduction in operating cost. If the rates charged for transportation could be increased proportionateiy, there would be no objection (outside of the inutility of the plan) to flat increases in wages; but it is a fact that cannot be disguised that there is always presenting itself (because it is a disease that thrives by culture) a constant demand on the part of employees for increased wages, so much so, that, combined with the cost of materials, railways having unsuccessfully attempted to meet such conditions by increased rates of transportation are now obliged, as a matter of self-preservation, to curtail their working forces.

Surely the idea underlying every increase in wages is not that

employees may have more money to spend, but rather that they may feel that their work is meritorious and is recognized, and will, consequently, render their best service. A flat increase in wages gives no such incentive to this; it robs men of individuality and places them in the position of merely keeping up with the herd. Under a plan of graduated wage promotion an appeal is made to the individuality of the employee. At the same time, it gives him a strong inducement to remain in the service, and to work intelligently and faithfully.

For reasons which are obvious, the division of employees into classes must, to a certain extent, obtain; the solution is in grading the classes. The basis for this grading is worth and length of service; discarding the principle that because a man is a brakeman, or a conductor, or an engineman, or a clerk, he should receive the rate of pay that pertains to that class of work; and instead applying the principle that because a man has been in the service a certain number of years, and is worthy, he shall advance from a lower to a higher grade.

The practice of frequent readjustments of wages has resulted in the absurd situation of enginemen and conductors receiving greater compensation than trainmasters and yardmasters and road foremen of engines, and brakemen getting greater compensation than yardmasters. Paying the superior less than the subordinate results in lack of respect for the directions of the superior; and a smaller salary cannot be considered an incentive to seeking advancement in the service. In these circumstances the employee loses interest, makes no effort to improve himself, and the effect is inefficiency and demoralization.

The suggestion of this paper is the application of graduated wage and promotion systems to railway trainmen, including enginemen; if practicable in these departments it can readily be adopted for all employees. It is, as before stated, a return to grades and the abolition of trip rates.

Again, there is the question of hours. The eight-hour day is here, and the railways should provide for it voluntarily. By a system of graduated salaries and the eight-hour day the operating cost will not be increased, and at the same time the wages of the senior employees will not be reduced. For example, a conductor or engineman receiving $125 to $150 under the present ten-hour, or trip rate, system should receive the same rate under the eight-hour scale, the increased cost to be met by a decreased force and a lower rate to the junior employees. There should be three grades of brakemen and firemen, and three grades of conductors and enginemen. The brakemen and firemen should reach the highest grade and rate in that line in three years. It should take conductors and enginemen longer—say, from five to ten years—but the difference in rate should be greater. It would take ten to fifteen years to work through the different grades of pay and promotion. There would always be some definite goal ahead, and after ten or fifteen years a man's family and social ties are established, and agitation would be a thing of the past. The graduated promotion means loyalty. Reward for worth will give loyal service, whereas the present system of practically one rate to all employees in the train service, and punishment for failure instead of reward for merit, can only result in disaster, trouble and loss. First, there is no incentive, which results in lack of interest; secondly, punishment is a custom of the past, and results only in sullenness and resentment.

The product of railways is not magnificent terminals, never-ending stretches of steel rails, powerful locomotives, or miles of cars, but it is transportation; and it is the cost of this that must be scrutinized and every factor entering into it constantly controlled. One of the factors making for unnecessary cost is the prevailing plan of compensating labor. Another factor is unproductive labor, much of which is devoted to the gathering and refining of needless statistics of every imaginable kind; a practice which causes an enormous amount of duplication and triplication of work. In other words, there is a condition of organization within organization. This cost to find cost has become burdensome.

ACCOUNTING OFFICERS' CONVENTION.

The Association of American Railway Accounting Officers held its twenty-third annual meeting at New Orleans, April 26, with about 200 members present. The business of the first day was the discussion of the new plan for interline ticket reporting which was presented by the standing committee on passenger accounts. This plan, which makes changes in some respects radical, was adopted. The principal reasons for making the change, as set forth in the argument for it, presented by Mr. Hermany, auditor of passenger traffic of the Rock Island Lines, are to save time, so as to enable each road to send its report to connections within about 20 days after the end of the month; and to give for each form of ticket, on all the reports to all the roads, a statement showing the revenue accruing to each road interested in that ticket. A separate sheet will be used for each form of ticket. The committee believed that the large majority of roads would deem it a considerable advantage to have these reports sent in season to allow the revenue to be taken into the accounts of the month in which it was earned. The plan has been tried by some of the members of the committee during the past year. The St. Louis Southwestern was able to mail its reports on the 15th and 16th of the following month. The Central of Georgia mailed its February reports on March 18. The principal saving in work is in the elimination of the apportionment book and in the use of carbon paper in preparing reports to be sent to foreign roads. The reports to all foreign lines are written at the same time. Smaller sheets can be used, but there will be a larger number of sheets. It will be necessary to sort agents' reports according to terminal carriers and intermediate routes, but this can be done by junior clerks. By the use of carbon sheets in preparing the reports to foreign roads each item is written but once and this makes a reduction of 25 per cent. in the time necessary for this work. In the experiments made by the committee it was found that of the total number of tickets reported, 75 per cent. read over two roads; 20 per cent. over three roads; 4 per cent. over four roads; 0.80 per cent. over five roads; 0.32 per cent. over six roads; 0.13 per cent. over seven roads; and 0.11 per cent. over eight or more roads. The roads making these experiments are the Baltimore & Ohio; the Rock Island; the Lake Shore; the Long Island, and several others.

By condensing the sales reported from the different stations according to connecting line junctions, the preparation of passenger statistics will be simplified, and it is estimated that this saving will amount to one-third. The road receiving these reports will have accurate and authentic information as to each junction through which each ticket passes; thus giving it information (not now available) as to actual mileage and revenue without waiting to check the reports by the coupons collected. Under the plan now in use there is much guessing as to the route of tickets and the elimination of this will not only promote accuracy of statistics but will save much correspondence. It is estimated that the average report will consist of seven times as many sheets as are now used. Members objecting to this increase are reminded that the settlement of freight accounts already involves a multiplicity of sheets, but this objection is over-balanced by the benefits. To the objection that the sheets would be worn out in handling, it was replied that when sheets are bound flat, this objection has no force. The experiments made on the St. Louis Southwestern show that the increase in the cost of stationery, including station reports, was about 15 per cent.

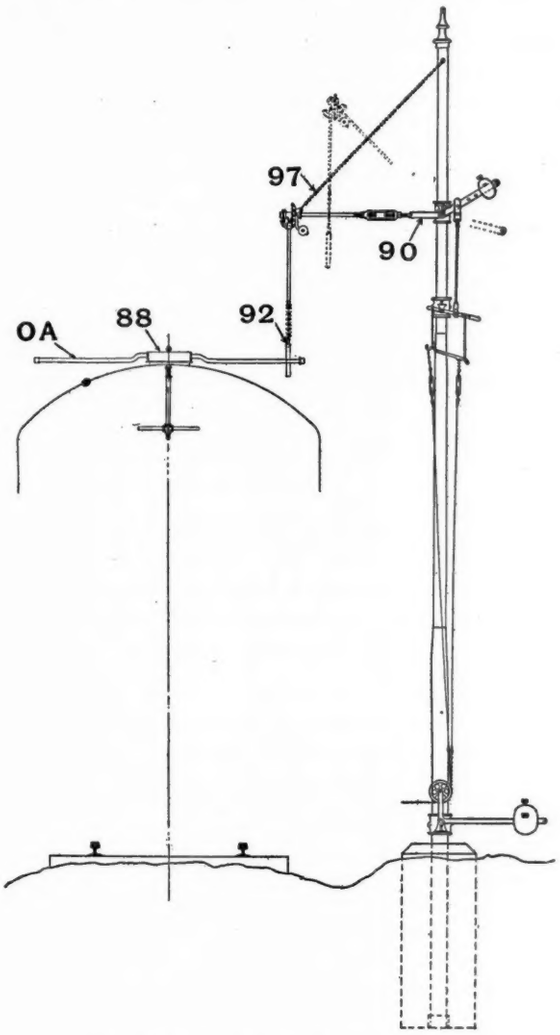
L. A. Jones, vice-president and comptroller of the New Orleans & North Eastern, the A. & V., and the V. S. & P., was elected president of the association for the ensuing year.

Work has been started on the construction of the northern section from Chaneral to Lagunas, of the Longitudinal Railway, Chile. The length of this section will be 465 miles.

HARRINGTON AUTOMATIC TRAIN STOP.

The Harrington Automatic Train Stop, which is in use on 11 miles of the Erie Railroad (Northern of New Jersey Division) has now been in service at all of the signal stations in that territory for over two years, and the construction and behavior of the apparatus are described at length in the last annual report of the Block Signal and Train Control Board. From that report we take the following descriptive matter and comments:

The system comprises an overhead mechanical-trip train stop and audible cab signal, invented by S. H. Harrington, of New York City. It differs from other mechanical trips, either of the ground or overhead type, in that the roadside apparatus, which is intended to actuate the apparatus installed upon the locomotive, is not a rigid structure, but consists of a movable support from which is freely suspended by a chain a cylindrical, tubular weight protected by an outer covering of vulcanized rubber. This suspended weight and its connections, called a "suspension," are so designed that the weight may be lowered into or raised out of the path of a horizontal arm extending transversely across the top of the engine cab, pivoted at its center on a vertical axis and designed by its motion about this axis to impart motion through suitable leverage to an air valve placed on top of the locomotive cab in an extension of the air-brake train line. The suspension moves the engine operating arm wholly by its inertia. If the engine is moving at very low speed, the operating arm is not moved. The suspension simply drags over it. The valve in the air-brake pipe is connected with a whistle so that every movement of the operating arm not only reduces the pressure of the train line, but also sounds an alarm.



Harrington's Automatic Train Stop.

The weight and chain forming the suspension are attached to the end of a pivoted arm, moving in a vertical plane mounted on an iron post placed alongside the track, and provided with suitable levers and wire connections so that by the movement of a lever located in a signal station a signalman may cause the arm and suspension to be raised or lowered. The suspension could of course be operated by compressed air, electricity, or other means commonly used to operate railway signals. The stop is supported on a post about 1,000 ft. in the rear of the home block signal.

The construction and the arrangement of the different parts of the apparatus are indicated in the drawing. The transverse arm on the top of the cab of the locomotive, *O A*, is called the operating arm, and the short arm below this, within the cab, is for the use of the engineman in restoring the operating arm to its normal position after a stop has been made. The "suspension" 92, has, at its upper end, where it is attached to the arm 90, a damping device to prevent excessive oscillation. The arrangement of the front and back wires, counterweights, and disengaging arms is similar to that ordinarily used with hand-operated semaphore signals. The position of the suspension when raised to permit the passage of a train is indicated by dotted lines. The air valve arm on the locomotive is held in its normal position by means of a notch in the upper surface of a curved shoe, pressed upward against the underside of the arm by a spring.

Sixteen locomotives, some freight and some passenger, are equipped with the apparatus, and at the roundhouse in Jersey City where these engines are kept when not running, there is a gage by which, when the engines pass out of the house, the operating arms on the engines can be adjusted. The inspector has also a wooden frame, to be placed across the track on top of the rails, with which to gage the distance of the suspension from the track, horizontally and vertically.

The inspector of the Block Signal Board made 269 tests of the stops with passenger trains, of which nine were failures and two others were unsatisfactory. Four failures were caused by the suspension being too low, two by its being too high, one because it was absent, and one because the operating arm rebounded on the shoe. In the case where the suspension weight was absent (it had fallen to the ground, having been separated from the chain) it is believed that the chain was broken, on the day before, when by reason of being out of adjustment, the suspension struck the roof of the cab of an engine. This maladjustment was caused by a new chain being installed and put in service without first having been tested by the gage. In one case where the suspension was not in the full stop position, the trouble was due to the breaking of a stake, which allowed a pulley to twist around the back wire and prevent its full movement. In another case the suspension failed to go to its full stop position because of lost motion in the connections. A variation of from one to three inches could be obtained by varying the speed with which the lever in the cabin was moved. Other failures were due to the operating arm in engines rebounding on the shoe and closing the valve.

These references to the record of failures as given in the Board's report, are cited here to illustrate the careful manner in which the tests were made. As will be seen below, the Board looks upon the faults developed as readily curable, and presents favorable conclusions.

In comparing this with other types of stops, the report calls attention to the objections to the use of an overhead stop. One of the first is the difficulty of arranging and adjusting the roadside apparatus and the vehicle apparatus, because of the narrow space between the equipment clearance line and the structure clearance line, due to the fact that engines and cars as wide and as high as it is practicable to use are common on all the railways

of the country. Brakemen do not ride on the tops of freight cars so much as formerly, but still they must frequently be in that position, and the presence of men on the cars must be taken into consideration. Running boards are provided on the tops of box cars, and trainmen should stay as near the center of the car as possible. The suspension device, when cleared for the passage of a train is raised to a point where it would not strike a man on top of a box car. When the device does act, it blows a whistle, which might offer a warning to a brakeman, though it is doubtful if this would be of benefit to a man on the front end of the train. Again, the suspension oscillates violently when it is struck by the engine arm and might hit a man standing on the running board. But during the two years and ten months in which the stop has been used no train man has been struck by it, and on the whole the objections to overhead stops seem to be accorded less weight than railway men have commonly accorded them in the past.

Summarizing its report, the Board says:

In spite of its constructive defects, the results of the operation of the stop on the Erie give strong promise that the device may be readily developed to a state of very considerable efficiency. It is hardly to be expected that any train-stop device will ever be perfected that will not sometime fail, or that such devices can be expected to do more than the engineman would do if alert and obedient to the indications of fixed signals.

The expense of installation and operation of fixed signals is considerable, and it is doubtless this expense that has prevented their use to such an extent that scarcely one-third of the railway mileage of this country is block signaled. On the block-signal mileage most of the installations are of the simplest and least expensive form. On over 80 per cent. of the mileage of the country the only fixed signals, except at occasional interlocking plants, consist of manual train-order or telegraph block signals. Furthermore, by far the greater percentage of accidents that might be prevented by the use of automatic train stops occur on roads that could ill afford complicated and expensive train-stop installations; so that the greatest field is for cheap and simple devices suitable for use with the ordinary type of manually operated signals. If they are also efficient with power-operated automatic signals, so much the better. The loss of property and life caused annually by accidents due to non-observance or disregard of signals is so great that the fact argues strongly for the encouragement of all cheap and simple devices that operate directly with the simpler forms of signals and which will be reasonably sure to perform their functions.

The Harrington system appears to provide means for a considerable step in this direction, and the Board concludes (1) that the Harrington stop should, if used, be operated either by reliable power devices, or by short, rugged, and direct mechanical connection to manually operated levers; (2) that if the constructive faults hereinbefore mentioned are remedied, and it sees no reason why they should not be substantially overcome, the sytsem, with reasonable inspection and maintenance, would be safe and reliable and its use would tend materially to promote safety of operation on a railway using it, and (3) that the expense to install and maintain it would appear to be so small, in proportion to the losses which its use might prevent, as to render desirable the encouragement of its development and design to meet all service conditions.

Progress has been made during the year on the Ichang-Wanhsien Railway, China, and there are now 30,000 men employed on it. Construction trains are running for five or six miles from Ichang, and the embankment is almost completed for about 13 miles. The first tunnel, which occurs at this point, and is some 1,000 ft. long, was successfully pierced several months ago, and work is being vigorously carried on at another tunnel 6,000 ft. long, as well as on the earthworks up to Kueichow, about 100 miles. The work is progressing even more rapidly than was expected.

NECESSITY FOR THE USE OF TRACK SCALES IN TIMBER TREATING AND RESULTS TO BE OBTAINED FROM THEIR USE.*

In the treatment of timber it is of the greatest importance that accurate means be used for determining the exact quantities of preservatives put into the timber and left in the timber. In most treating plants, both in this country and abroad, the actual quantities of preservatives injected into the wood are measured by volumetric determination, that is, the amount of liquid injected is determined by measuring the quantity of liquid in the storage tank before the treatment and again after treatment, the differences (measured in gallons) being taken as the quantity injected into the wood. The volumetric method, with care and attention, can be made to record the quantities of liquid absorbed with great accuracy, and in many of the modern treating plants the degree of accuracy obtained in making volumetric determinations has been excellent. There are certain factors of error in making volumetric determinations, however, which it is almost impossible to avoid. In order to assist in correcting these errors and to check the volumetric readings, many treating plants have installed small track scales as a part of the equipment of the plant. These scales are generally used to check the volumetric determinations, that is, the timber is weighed on these scales before treatment and immediately after treatment. It should be pointed out, however, that even with the most careful work, the determination by careful weight of the liquid absorbed is not absolute. The degree of seasoning must be taken into consideration, except where thoroughly seasoned timber is treated, and the amount of moisture that may be in the timber, caused by a heavy rain, or the amount of snow and ice which accumulates on it, as well as the tram cars in the winter time may be a source of considerable error. Some of the preservatives injected will usually run out of the timber during the period between the end of the treating operation and the end of the weighing operation, or in the case of creosote oil a certain percentage of the oil will evaporate from the hot timber before the end of the weighing operation is reached. The tram cars should be light-weighed and stenciled, and should be re-weighed as frequently as necessary to check the tare weights.

The value of the track scale, however, in connection with the operations of the timber treating plants, lies in the fact that the determinations of the liquid absorbed by weight act as a check on the determinations by volume. With careful work the determinations by weight and volume should check reasonably close.

From the answers which the sub-committee has received, it appears that most of the railway companies in this country use the track scale occasionally to check the volumetric readings, and in one case every tram of timber or ties treated is weighed before and after treatment. It would be extremely desirable that determinations of the preservative absorbed be made for every run that is made. There are so many variables in the treatment of timber due to the nature of the material and to the varying conditions of seasoning that any method which would increase the regularity of the treatment should be adopted.

In view of the fact that past experience has shown that there are always some differences in the readings by weight and volume, the committee has endeavored to ascertain how great the variations may be and still indicate fairly accurate determinations. According to the reports of some of the European railways, a variation of 15 per cent. between volumetric readings and weights is allowable. In this country the variation hardly ever reaches such a high figure; in the majority of instances they will not be more than 10 per cent., and usually much less than that.

If correctly designed scales are properly installed and maintained and a reasonable amount of care exercised in weighing, making allowance for conditions which may affect results as obtained by weighing and volumetric determinations, there should be even smaller variations between the two methods.

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*From Appendix F of the Report of the Committee on Wood Preservation, presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association.

The design and size of scales to be installed will depend on local conditions and the sizes of timber to be treated.

Having in mind a scale for general use, such as the weighing of ties and timber up to 35 or 40 feet in length, it is the recommendation of the sub-committee that a 22-foot, 2-section, 50,000 pounds capacity, suspension bearing platform scale be installed directly on cast-iron plates embedded in concrete, with the pit of sufficient size to permit thorough inspection and cleaning.

The platform bearings should be of sufficiently rigid I-beams, and on top of these should be placed the ties carrying the scale rail stands. The deck should be rigid and not connected with the scale, but shields applied to the rails to keep as much dirt and water out of the pit as possible. The scale should be fitted with a capacity beam, graduated and sensitive to 8½ lbs. in 50,000 lbs.

This type scale is recommended for the reason that it is so designed as to be accessible in all of its parts for thorough cleaning and inspection, owing to the desirability of the suspension feature over scales where the shock is transmitted to the bearing points with a direct thrust. It should be purchased and installed for approximately $1,200.

A two-section scale is recommended on account of its greater accuracy over one containing more sections, and 22 ft. is about as long as it is desirable to install a two-section scale.

While various lengths of tram cars are used by various railroads in timber treating plants, it would seem that one about 7½ ft. long, with 5-ft. wheel base, would be the most desirable, inasmuch as the bottom ties will then project over the end of the car, providing a hand-hold at each end when unloading. Such a scale as recommended above will permit weighing of two trams at a time, if necessary or desirable.

In case ties alone are to be weighed in single tram loads, a scale 10 to 12 ft. in length and of ten tons capacity, of the "A" lever type, similar to those ordinarily used in warehouses and for wagon scales, may be used. The cost of this scale will be approximately $350, installed with concrete and timber.

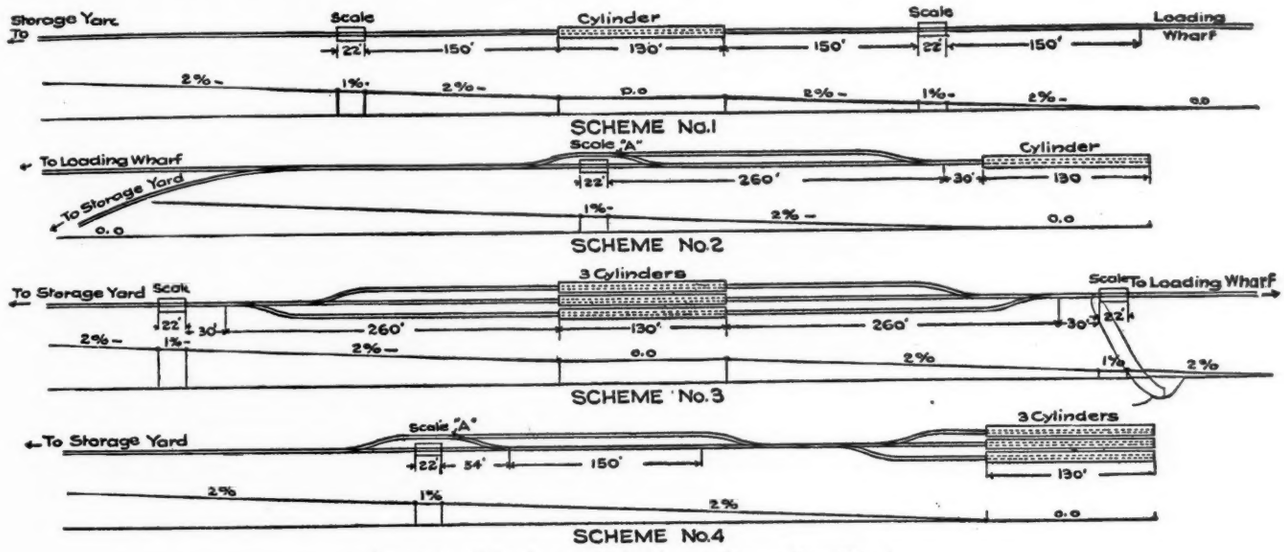
For more enduring accuracy and service, it is recommended that a 10 to 12 ft., 15-ton scale of the suspension bearing type, similar to the 22-ft., two-section scale, already described, be installed with concrete and steel at an approximate cost of $700.

Attached hereto is a sketch showing the proposed location of scale and arrangement of tracks, where one or more cylinders are used, and where trams are shoved into one end of the cylinder and pulled out of the other, or where shoved into and pulled out of the same end. Such an arrangement permits trams to be weighed ready to be placed into the cylinder as soon as it is emptied, without delaying the output of the plant. If the profiles shown can be adopted the trams may be handled to advantage by men instead of engine, when weighing.

The tracks, switches and cross-over are so arranged as to permit weighing at all times on descending grade. If local conditions do not permit of the arrangement as shown on sketch, with the advantages outlined above, the arrangement will have to be modified to suit the conditions.

Attached is a statement showing information in regard to scales located at various timber-treating plants. It would seem from most of the replies that a depot scale has been installed, and, while satisfactory for freight house and other light work, is not desirable for track scale weighing, in that it is not durable and the arrangement of the levers is such that the friction is across the knife edges instead of in the direction of its length. It is also impossible to clean and inspect it with the same thoroughness as the scale recommended.

One of the members of the committee recently visited a large number of the European timber-treating plants and made special



Layouts of Scales and Tracks at Creosoting Plants.

Recommended profile to facilitate weighing trams to be weighed on descending grade. If local conditions do not permit such grades they will have to be changed to suit. Crossovers marked "A" near scale are there to prevent unnecessary use of scale.

STATEMENT SHOWING INFORMATION IN REGARD TO SCALES LOCATED AT TIMBER TREATING PLANTS.

Road or Company.	Location of Plant.	Length of Scale.	Width of Scale.	Capacity.	Beam Graduation.	Cost.	Remarks.
Illinois Central	Memphis, Tenn	5 ft.	5 ft.	9,000 lbs.	2 lbs.	$74.00	Not including installation, scale an old one.
D. L. & W.	Paterson, N. J.	8 ft.	4 ft.	15 tons	2½ lbs.	403.83	$223.83 of this for installation.
Lehigh Valley	Bound Brook, N. J.	7 ft. 10¾ in.	4 ft. 10½ in.	31,000	5 lbs.	275.00	$100 of this for installation.
C. B. & Q.	Galesburg, Ill.	20 ft.	4 ft.	40,000	20 lbs.	.....	
Frisco	Hugo, Okla., and Springfield, Mo.	7 ft. 9¾ in.	4 ft. 10 in.	.....	.....	600.00	$246 of this for track charges.
Rock Island	Tie Plant, Ark., and Kansas City, Mo.	8 ft. 3 in. 7 ft. 11 in.	5 ft. 3 ft. 11¼ in.	....	20 lbs. 20 lbs.	504.36 473.64	$364.36 of this for installation. $333.64 of this for installation.
West Pascagoula Creo. Co.	Gautier, Miss.	None	.....	.....	.....	.....	Recommend scales.
Texas and Lumber Pres. Co.	Somerville, Texas.	8 ft. 38 ft.	....	8,000 120,000	..... 10 lbs.	..... 480.00	Not clear whether this is cost of scales alone or includes installation; should think just the scales.
M. K. & T.	Dennison, Texas	None	.....	.....	.....	.....	Recommend 40 ft. scale, 6 to capacity.
N. P.	Brainerd, Minn.	.....	Small scales to weigh a tie.				Recommend a track scale.

inquiries as to the prevailing practice concerning the use of track scales in connection with the treatment of ties and other railroad timbers. It was found that almost all of the timber-treating plants on European railways are equipped with track scales, and at most of these treating plants all ties and other timbers are weighed on trams before being treated and again after treatment. This method of checking the oil absorption is possible because of the small daily output of treated material. Most of the cylinders hold only from three to four trams of ties. These trams are pushed onto the scale by hand before treatment and again after treatment. The weighing operation takes about five to ten minutes for each tram, because in the majority of instances the scale is situated at the end of a spur track and the tram has to be pushed onto it, weighed and pushed off again before the next tram can be weighed.

The type of scale used differs materially from that hitherto used in the United States. Practically all of the scales are the so-called printing scale, that is, the operator pushes a number of levers on the scale arm until the scale balances, a card is then pushed into the slot, and, by pressing on a small lever, the exact weight is printed on the card. Errors of observation are thereby made practically impossible. There are frequently several thin sheets of paper pasted to the cars which are used so that duplicate and triplicate slips are made at one pressure of the lever, one slip remaining with the treating company and the others with the railway officer in charge. These scales weigh with great accuracy, weights being obtained down to one (1) kilo, which is equal to 2.2 lbs.

A visit was made to a large scale factory, where a type of scale is now being made which weighs cars and records the weights automatically, that is, the cars are run over the scale slowly, and each car stops on the scale platform only long enough for the weight to be registered. This registering is made on a small card, which drops into a small box at the side of the scale box. These automatic scales are now being made in this country, and are worthy of serious consideration.

The general impression obtained, after visiting many of the European timber-treating plants, is that the timber-treating engineers are fully convinced that the weighing of timber before and after treatment is very desirable and of great assistance in regulating the treatment. They stated that the weighing of every charge is very desirable but not essential, and, where the weighing of every charge was carried out, it was explained that this was done, owing to the fact that the time required was insignificant at a plant treating only a small quantity of material daily.

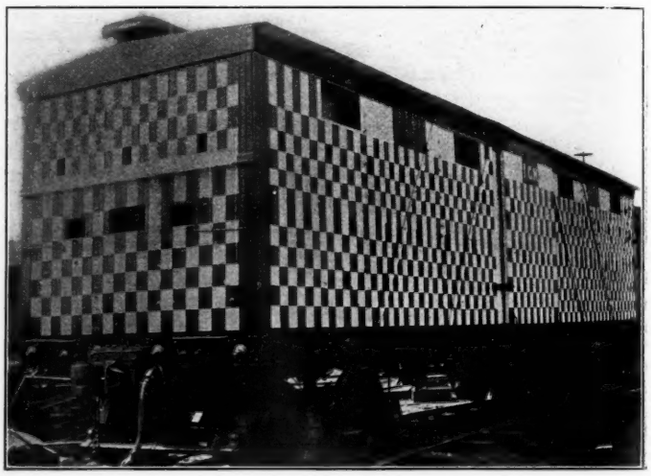
Another point of great importance in connection with the weighing of timber before and after treatment is the variation observed between volumetric readings and weight readings of the preservative actually injected. Without going into details, it may be stated that the variations observed between weight and volumetric readings in the European treating plants was very much greater than those which have been obtained in the United States. At one plant the variation in 16 runs showed the average absorption as indicated by weight to be 6 or 7 per cent. below the average volumetric readings (the minimum being 2 per cent. and the maximum 16 per cent.), and in four cases the absorption by weight was greater than the volumetric reading, the minimum being 1 per cent. and the maximum 20 per cent. The government officials at this plant indicated that these were usual conditions.

It is particularly gratifying to the committee to report that the American operative methods have shown a very much closer approximation between the volumetric and weight readings than has been the case in the European plants. It was noted in the accompanying diagram, showing the results of weights taken at one of the American timber-treating plants, that the variation average 2 to 3 per cent.

The general findings of the sub-committee are that track scales are now being used at a small number of treating plants in this country, and quite generally in Europe they are used to check the work of the plant, with excellent results. The committee recommends that the track scale be installed at every treating plant wherever possible. After their use has become general, it will be possible to obtain data which will permit one to state more definitely the variation which will take place in treatment, and thus enable one to formulate some general rules as to the extent of allowable variation.

ARMORED BOX CAR.

A car fitted up for military use by the Mexican government is shown in the accompanying illustrations. It is made from an ordinary box car, the inside of which is lined with steel armor plate. By referring to the interior view of the car it will be seen that there are port holes at the end and on either side. Three of



Armored Box Car for the Mexican Government.

the end holes are for two machine guns and one rapid fire gun. There are also eight windows at the top of the sides, which are used for ventilation when the car is not under fire. They are protected by steel shutters, which are slid over them when the car is in the danger zone. Ladders are placed at both side doors, so arranged that they can be readily swung down as soon as the door is opened, or lifted up into the car after it has been loaded.

Interior of Armored Car.

It will be noticed also that the ceiling is lined with metal, which provides protection from any attack made from vantage points above the car. Although this car would not be a protection against shells, it is of decided advantage where only musketry fire is concerned. The outside of the car is painted with the checkered effect to hide the location of the port holes, for, as will be noticed, these holes come directly in the dark patches and at a few hundred yards would look like all the other dark patches.

Shop Section.

HOW scientific management can be applied to a railway shop will be the subject of the competition to close June 15. We have been very frank in calling attention in these columns to the mistakes made by efficiency men. At the same time we have insisted that much good could be accomplished by a more scientific application of the principles of efficiency. The efficiency engineers have undoubtedly profited by the discussion of the past few months and we feel that it is only right that they should be allowed to state their case fairly. Three prominent railway mechanical officials have signified their willingness to act as judges—H. H. Vaughan, assistant to the vice-president of the Canadian Pacific, G. W. Wildin, mechanical superintendent of the New York, New Haven & Hartford, and T. S. Lloyd, superintendent of motive power of the Delaware, Lackawanna & Western. These men are all regarded as more than ordinarily successful motive power officials, and as men who are willing to consider without prejudice any practical suggestion which promises to give good returns for the investment A prize of $50 will be awarded for the best article and $35 for the second best. Such others as may be accepted for publication will be paid for at our regular space rates.

THE shop kink competition, announced in the February and March Shop Numbers, will close May 15. A first prize of $50 will be given for the best collection of three kinks which are used in connection with the repair or maintenance of rolling stock and other equipment in charge of the mechanical department. The second best collection will be awarded a prize of $25. Contestants may submit more than three kinks, allowing the judges to base their decision on what they consider to be the best three in the collection. Kinks accepted for publication, but not awarded a prize, will be paid for at our regular space rates.

LAST month we announced a competition on reclaiming scrap material, to close June 15. Because of the announcement in this issue of another competition to close on that date the time limit for receiving articles on the reclaiming or utilization of scrap material will be extended to July 15. It is probably safe to say that every railway mechanical department in the country has studied this question and that some phase of it has been followed up and developed on each of the roads. Some have specialized along certain lines with good results, but have paid little attention to other features, often of as great, or greater, importance. What we want to draw out and place on record are articles telling what methods have been used successfully for reclaiming and using materials of various kinds which are used in the maintenance and repair of equipment in charge of the motive power department. The best article will be awarded a prize of $35 and the second best a prize of $20. Articles not awarded a prize, but accepted for publication, will be paid for at our regular space rates.

THE competition on the instruction of apprentices and workmen, which closed April 15, was unusually successful. The first prize of $35 was awarded to H. S. Rauch, apprentice instructor, New York Central & Hudson River, Oswego, N. Y., and the second prize of $20 to John H. Linn, apprentice instructor, Atchison, Topeka & Santa Fe, Topeka, Kan. All of the other contributions have been accepted for publication. The other contestants were Le Roy W. Alison, Los Angeles, Cal.; L. L. Collins, bonus inspector, Atchison, Topeka & Santa Fe, Albuquerque, New Mex.; D. C. Davis, apprentice inspector, Atchison, Topeka & Santa Fe, Newton, Kan.; Henry Gardner, assistant superintendent apprentices, New York Central Lines, New York; Joseph W. L. Hale, head instructor, Pennsylvania Railroad school for apprentices, Altoona, Pa.; Richard Keefe, apprentice, New York Central & Hudson River, Oswego, N. Y.; John V. Le Compte, foreman, Baltimore & Ohio, Garrett, Ind.; E. B. Ralph, apprentice instructor, Atchison, Topeka & Santa Fe, Fort Madison, Iowa; William G. Reyer, general foreman, Nashville, Chattanooga & St. Louis, Nashville, Tenn.; F. M. M. Richardson, educational secretary, Railroad Department, International Committee of Young Men's Christian Associations, St. Louis, Mo.; and our old friend, the Old Railroader.

THE judges had anything but an easy task in awarding the prizes in the competition on the instruction of workmen and apprentices. The articles submitted were exceptionally good. The chief merit in Mr. Rauch's ("Dad Rauch," as his apprentices delight to call him, although he is not a great many years older than some of them) article is that it so forcibly directs attention to the spirit which must underly any successful apprenticeship system. Such a system cannot be operated mechanically; it must have all the warmth and inspiration which can be given to it by big-hearted men with a love for their fellows. Mr. Linn, the winner of the second prize, is not only an apprentice instructor on the Santa Fe, at Topeka, but is also chief clerk to F. W. Thomas, the supervisor of apprentices, and without doubt has, because of his close association, absorbed much of Mr. Thomas' wonderful gift of understanding, appreciating and developing the boys under him. Mr. Gardner, of the New York Central Lines, has tackled the problem from a rather unique standpoint, and emphasizes the relation of education to industrial waste in a forceful manner. To Mr. Richardson we are indebted for a splendid description of the way in which the Y. M. C. A. is assisting in this work and of the results which are being obtained. It is rather surprizing that so little publicity has been given to this important phase of the work. Mr. Hale of the Pennsylvania is equally as enthusiatic over the advantages and possibilities of modern apprenticeship as are his associates on other roads. Mr. Keefe was the only apprentice to enter the competition, and his conception of the opportunities in railway service is of special interest.

THOSE who are intimately acquainted with David Van Alstyne expected a big, broad conception and view of the problem of the science of management, when it was announced that he would present a paper on Practical Ethics at the Congress of Technology at Boston—and they were not disappointed! Intensely earnest and practical in his work he has a keen realization of the fact that the American workman will quickly respond when he realizes that he is being given a square deal. In his article, a large part of which appears in this issue, he shows how detail management, as he calls it, will do much to close the gap between employee and employer, uniting them in harmonious co-operation and cultivating in each a broader sympathy for the welfare of the other. His comments on that most serious defect of our industrial system, which results in large numbers of men being out of employment a considerable portion of the time, demand the attention of all those who are interested in bettering the conditions of our industrial workers and making them more efficient employees and better citizens. Unquestionably the establishment of sociological departments by large employers of labor would bring splendid returns, although it would be a question of several years before their influence and effect would be fully realized. They would necessarily have to be in charge of big men. The methods of getting in touch with the men and bringing them to see that the welfare of employer and employee are dependant one upon the other, would be varied and would have to be carefully studied to suit the special conditions in each case.

IMPROVEMENTS IN SPIRAL MILLING CUTTERS.

THE change from a straight to a spiral cutter for milling machines was an important improvement, but the desire for larger output per hour has forced the spiral cutter, as formerly made, to the limit of its capacity, and a further change has been found necessary. An analysis of the conditions under which these cutters work has shown that the tooth compresses the metal until it causes a plane of cleavage at some angle with the direction of the cutter, and then begins to compress a new piece and push it off. The chip made by a milling cutter is quite different from that produced by a lathe or planer tool. The latter makes chips of uniform section, while the section of a milling chip increases from zero to a maximum.

When the cutter revolves it penetrates into the work and compresses it, which results in a springing of the arbor. After a certain amount of spring, the blade begins to remove a chip. It is believed that this action more than any other causes a dulling of the cutter. With a light cut it is possible that one tooth would fail to take a chip and the succeeding tooth would remove double the amount of its normal cut. This action is inherent in milling cutters, and recently experiments have been made by the Cincinnati Milling Machine Company for the purpose of discovering some method of minimizing these results. The ability of a milling cutter to remove metal is also limited by the relation between the size of the chip and the space between the teeth. This limitation does not exist with lathe or planer tools, as the chips or turnings have ample space in which to flow off. It was found that with the ordinary spiral milling cutters the amount of metal removed per tooth was sufficient to fill the chip space, and the capacity of the cutter was limited to small output; but when the space between the teeth was increased to allow ample room for the chip, a given amount of metal was removed with less power. This fact has led to the adoption of standard cutters 3½ in. in diameter, with only 9 teeth and 4½ in. in diameter with 10 teeth, corresponding to a spacing of 1¼ in. between the teeth. The chip space is thus made four times as large as that in general use at the present time.

By the use of these improved milling cutters, the amount of metal removed per horse power has been largely increased, and the capacity of the knee and column milling machine has been considerably enlarged without increasing its size or weight. Experience with these cutters has shown that they have other advantages, and few, if any, of the minor disadvantages which might have been expected. In roughing ordinary work the wide-spaced cutter remains sharp for a longer period, even where the feeds have been increased, and in many cases double the amount of work can be done without re-sharpening. With a smaller number of teeth, it is also found that the time required for re-sharpening is only one-half that for the fine-toothed cutter.

The ratio of the pitch to the depth of tooth is practically the same as with the older form, and the depth of the new tooth is about twice as large as formerly, so that the cutter can be sharpened a greater number of times, and its life is thereby considerably increased. Another advantage of the wide-spaced tooth is the fact that, while at first glance it has the appearance of weakness, it is always stout and well proportioned, and while breakage of the old cutters is not frequent, the new ones do not break even when subjected to the heaviest class of service. It might be thought also that the wide spacing of the teeth would cause the feed to act with a jerk, but the feed is smoother and there is less jerk when the cutter first strikes the work, because there is less spring in the arbor, which is made larger than formerly, and less tendency for the cutter to ride over the work.

The new spiral cutter is particularly well adapted to milling cast iron, and with it there is a notable absence of jerking and chattering which is often found in milling this material. Where very smooth finish is required it has been the custom to use a roughing cutter with a chip breaker, followed by a fine-toothed cutter without the breaker, and this requires a large number of extra cutters. Another advantage of the wide spaced cutter is the fact that the chip breaker can be used without affecting the smoothness of the finish, and only one cutter is required for roughing and finishing. Drawings of these cutters and diagrams showing the power required for various feeds accompany a paper by A. L. DeLeeuw in the April *Journal of the American Society of Mechanical Engineers.*

PLANS FOR LOCOMOTIVE REPAIR SHOPS.

DURING the past ten years over 70 locomotive repair shops have been built or completely renovated, and it is estimated that more than $80,000,000 has been spent on these plants in the United States and Canada. This work required the making of numerous plans, most of which have been worked out with reference to those which preceded. It might be expected that the best features would finally prevail in some typical design which would be accepted by general agreement as ideal. While there is some evidence that the process of developing such a typical design is going on—such evidence being afforded, for example, by the similarity of the cross sections of most of the new main locomotive shop buildings—there is still a diversity of opinion and practice as to general arrangement and size, and it is not likely that such matters will ever be completely standardized. H. H. Maxfield presented a paper on a General Plan for a Locomotive Repair Plant at the January meeting of the New York Railroad Club and the discussion which it called forth illustrated how widely the views of different men differ on this subject. An abstract of the paper and the proposed shop plan will be found elsewhere in this issue.

The first important difference of opinion developed by the discussion related to the average number of engines which can be repaired per erecting pit per month. The author found it possible under conditions in his district to repair three locomotives per pit per month, and on this assumption provided an equivalent of 25 pits in a longitudinal shop for the repair of 900 engines per year. Others thought two engines per pit a fair average, as with the best facilities it requires 25 days to install a new firebox and make general repairs, and at least ten days to make heavy repairs alone. A large space, 9,800 sq. ft., at one end of the erecting shop, marked "frame department" will be noticed on the plan. This can be used for frame repairs and for the storage of frames with cylinders on them, while the boilers are being equipped with new fireboxes in another department. This space, equal to 7 pits, relieves the live erecting pits, so that the actual number of pits available is $25 + 7 = 32$ pits; on the basis of 75 engines repaired per month, the number for equivalent pit space is less than 2.5 engines per pit per month. There can be no fixed unit for this output per pit. It must vary with the number of engines requiring new fireboxes and with the number of machine tools and their output. The conditions should be such that there will be a constant and ample flow of finished details from the machines to the erecting floor, and no delays awaiting material.

In the plan proposed by Mr. Maxfield the floor space provided for light and heavy machine tools is 46,000 sq. ft., or 1,840 sq. ft. per erecting pit, which is not a large allowance, but ample if the shop is equipped with modern tools, most of which are motor driven. The saving in space which is possible where motor driven tools are substituted for those using belts and countershafts is well illustrated in the article on the "Re-Arrangement of Machine Tools in the Union Pacific Locomotive Shop at Omaha," which was published in the *Railway Age Gazette* of December 2, 1910, page 1084.

The floor space for the boiler shop and smith shop is usually determined with some reference to that of the erecting shop, or to the total floor space of the erecting and machine shops. In Mr. Maxfield's plan the boiler shop has less than 27 per cent., and the smith shop less than 15 per cent. as much floor space as the main locomotive shop. These proportions are much smaller than are found in any modern shops. The ratio is usually 60 to 80 per cent. for the boiler shop, and evidently must

vary with the quality of the water used in the boilers. The floor area of the smith shop is usually 35 to 45 per cent. of the floor area of the main locomotive shop, but the tendency is for the floor area of the smith shop to be made less on account of the very large substitution of steel castings for forgings and the increased use of machine forgings which require a comparatively small amount of floor space. At many places the smith shop supplies a considerable amount of car forgings and bolts, but the plan here considered is for locomotives only.

Coming now to the general arrangement of the buildings in the proposed plan; the first obvious suggestion is that a craneway be provided for the midway between the boiler and the erecting shops, as there appears to be no provision made for the transportation of forgings from the smith shop to the machine shop, except by shifting on the longitudinal tracks. The midway space could be utilized to some extent for the storage of material or for frames, cabs, pilots, etc., which usually occupy floor space in the shop. The plan would be improved if that space were omitted altogether, and, as the boiler shop has the same cross section as the machine and erecting shops, they might as well make one continuous building. It is a fault of most shop plans that there are too many buildings, and they are too widely scattered. The plans should be more compact, even providing for a second story in some instances. When two large buildings having the same cross section are placed in line, with a space 80 to 100 ft. between them, this intermediate space only increases the distance that must be traversed in the movement of materials and men. If the gable ends were swung around through 90 deg., they would form the side walls, with a considerable number of bricks to spare, and the only expense for 80 or 100 ft. additional length of shop would be for the roof. This economy in the cost of shop buildings could be effected in numerous instances, where expensive gables are used on comparatively short shops.

A transfer table, while useful in a car shop, is not necessary in a locomotive shop where cranes are provided for placing the engine on the through track where it has a direct outlet. One of the principal objections to it is that it affects the construction of the shop walls, requiring large doors opposite every track instead of a continuous side wall with large doors for engine exits at the ends. A more serious objection to the transfer pit relates to the movement of men and materials. The rates of wages for labor are now so high that shop plans should provide for the concentration of materials so that they can be handled directly from the store platform to the machine tools, and from these to the locomotive. The transfer pit usually occupies space alongside the erecting shop and the sides or ends of several shops on the opposite side, and this space could be more advantageously occupied by storage platforms and overhead traveling cranes.

A notable merit of the plan proposed by Mr. Maxfield is that the heavy machine tool department is located adjacent to the principal material platform, and four doorways with tracks are provided for delivering material directly from the store to the tools. The tendency in shop design is more and more in the direction of a plan which will dispense as far as possible with lost motion in handling heavy material like castings, steel plates, tires, tubes, etc. Castings and tires should be on a platform directly in line with the machines where they are to be finished, and it is probable that the bulk of tubes and sheets could be stored to advantage in the boiler shop or directly outside, where they can be handled by the traveling cranes. The sub-store idea also extends to small fixtures and has become so important a part of the locomotive shop as to require about the same area as the tool room, and it is managed so that material is only obtained by requisition from a representative of the store's department.

A final criticism of the shop plan in question is that the power house is too far removed from the main buildings, which are heated by large exhaust pipes. These pipes are expensive on account of their size, and the loss due to radiation in the long distance is large. The expense for the pipes and the tunnel could be largely reduced. It is possible to place the power house near the smith shop, and yet have it much closer to the center of the shop system.

The "after trial" shop is a new feature in shop planning and appears here for the first time as an essential part of the original plan. Such a provision is necessary for any shop having as large an output as two or three locomotives per day, and it is seen in the plans of a large locomotive shop now under construction. It should be located near the erecting and machine shops, so that too much time will not be lost in the passage of workmen between the shops.

THE MIKADO LOCOMOTIVE.

WHILE the consolidation locomotive is still the prevailing type for freight service, the orders during the past year indicate that the Mikado is growing in favor, and it is now used in large numbers by the Baltimore & Ohio, the Southern Railway, the Illinois Central, the Burlington and the Oregon-Washington Railroad & Navigation Company. A Mikado locomotive for the latter railway was illustrated in the *Railway Age Gazette*, January 27, 1911. In the wheel arrangement the Mikado has a leading pony truck, eight driving wheels and a trailing pony truck. It may be regarded as a consolidation locomotive with a trailing truck, or as a Prairie type with an additional pair of drivers. The extension of the boiler shell for tubes 21 ft. long places the firebox so far back that the trailing truck is necessary, but it also permits of the use of large drivers. The Mikado engines built for the Burlington have 64-in. drivers, this being the largest wheel thus far applied by the Baldwin Works to an eight-coupled locomotive. The front truck wheels on this engine are 37¼ in. in diameter, and the trailing wheels 42½ in. in diameter. The rear truck wheels are also useful in guiding the engine when backing into switches and crossovers, and in yards where the track is not kept close to gage. The weight on drivers, 50,000 lbs. per axle, is about the same as that on the larger consolidation locomotives, and provides sufficient adhesion for a tractive effort of 50,000 lbs. The cylinders are so proportioned that this amount of traction is obtained with the moderate working pressure of 170 to 180 lbs. The large driving wheels of the Burlington locomotives naturally require large cylinders, and they are 27 in. x 30 in. in size.

One of the principal advantages of the Mikado as compared with the consolidation is the use of larger boilers which are as large as 82 in. in diameter at the first ring, allowing the use of nearly 500 two-inch tubes, 20 to 21 ft. in length, and providing over 5,000 sq. ft. of tube heating surface. The large boiler capacity enables the engine to develop a greater horse-power, and it can, therefore, haul a given tonnage at higher speed than the large consolidation locomotives. The ratio of heating surface to grate area, 90 to 1, is very much larger than that used under the old rules, and this must result in a substantial economy in fuel. The large firebox and long tubes have been utilized in the successful combustion of lignite and other low-grade fuels, and the spark troubles have been eliminated by the low rate of combustion and the long passage through the tubes. If the grade of fuel requires a deep firebox, it can be more conveniently placed over the trailer wheels of the Mikado than over the drivers of the consolidation.

These are some of the principal features of the Mikado locomotive as distinguished from the larger freight engines in general use heretofore, and these qualities recommend it to railways having a heavy traffic over long grades, or for pusher service on the shorter but steeper grades. It offers some relief, also to those lines which feel the need of a more powerful locomotive than the consolidation, but do not have proper facilities for taking care of Mallet locomotives.

The Mikado engines for the Burlington include features which are somewhat out of the ordinary construction, and are worthy of mention. They have rather a long rigid wheel base, 16 ft. 9 in., but the trucks have sufficient swing to enable the locomotive

to traverse 20-deg. curves. The side water legs of the firebox taper in width from 6 in. at the front to 4 in. at the back, and this appears to be an attempt to make the area of cross section of the water space somewhat proportional to the volume of water passing through, producing a better circulation of the water on the side sheets, where the rate of heat transmission is the greatest. The engines have superheaters, and an equalizing pipe connects the live steam passages in the cylinder saddles. The value of this was pointed out in the article relating to the tests of superheaters on the Lake Shore and Michigan Southern, published in the *Railway Age Gazette* of March 31, 1911. In those tests the crossover pipe was a temporary measure used to connect the two steam pipes at the bottom of the smokebox, while in the Baldwin design the equalizing pipes are made a permanent feature by incorporating them in the cylinder saddle casting.

While bronze hub liners are often used in repairs, in these engines the steel wheel centers have bronze hub liners supplied by the builders, and the shoes and wedges are also made of bronze. One other improvement indicates that the fireman is kept busy and must be assisted, if not by an automatic stoker, by having the coal moved near the fire door. This is accomplished by making the sloping floor of the tender movable and with hinges in front. The rear portion is raised by a steam cylinder and the coal is thus moved forward toward the fireman as he needs it.

HELICAL CUTTERS FOR MILLING.

At the Pittsburgh meeting of the American Society of Mechanical Engineers, A. L. DeLeeuw will present a paper on the Efficiency of Milling Cutters, in which he gives the results of tests of new shaped cutters which have a much higher efficiency than the older forms. The new type of helical cutter is particularly interesting and worthy of a brief description with some account of its performance. These cutters, which are illustrated elsewhere in this issue, have a cylindrical body with two or three screw threads turned on the solid, the helix forming an article of 69 deg. with the axis; for cutting steel the side of the cutter forms an angle of 17 deg. with a vertical line, and the top of the cutter an angle of 8 deg. with a horizontal line. They are made either with a single helix or with one right hand and one left hand interlocking.

The peculiar feature of these cutters is that they push the chip off in the direction of the axis of the cutter, or at right angles to the feed. The power consumption for cutting steel is so low that a roughing cut requires only about one-third the power used by the old style spiral mill. For cast iron their performance is not so favorable. As they do not make revolution marks, a much coarser feed can be used for finishing, and a cutter with three teeth will allow a finishing feed three times as fast as the ordinary spiral cutter. On account of the direction of thrust being parallel with the axis of the arbor, there is a complete absence of spring in the arbor in cutting steel. This fact makes it possible to use the milling machine without braces in most cases where they would be otherwise needed.

The end pressure on the spindle is not excessive, and although the interlocking right and left hand helix was made to obviate this objection, little advantage was found from it in this respect. The best results are obtained when running at the usual speeds of the ordinary spiral cutter, and the new cutters show a remarkably low power consumption in cutting steel as compared with any other form of cutter. Mr. DeLeeuw explains why the new helical cutter shows a less saving in power on cast iron than on steel by saying that a cutting tool must detach the chip by bending and partially breaking it. When cutting steel, the radius of curvature of the chip becomes greater with increased rake, and the extent to which the chip is broken off becomes less. Cast iron allows much less bending before breaking, so that even with the increased rake, the chip is still broken up, as when the usual form of spiral is used, and no saving of power is possible. These new cutters have been found especially useful in the rapid cutting and finishing of tensile test pieces of boiler and structural steels.

MECHANICAL ARTICLES DURING APRIL

The following articles of special interest to mechanical department readers, and to which Shop Number readers may wish to refer, have appeared in the weekly issues of the *Railway Age Gazette* since that of April 7:

The Largest Locomotive. A brief description of three Mallet locomotives recently built at the Topeka shops of the Atchison, Topeka & Santa Fe. They were made from two decapod locomotives and have the 2-10-10-2 wheel arrangement. The total weight of engine and tender is 750,000 lbs. and the rated tractive effort is 110,000 lbs. These locomotives are said to be the largest in the world. April 14, page 906.

Electric vs. Steam Locomotives on the New Haven. Abstract of a paper read before the American Institute of Electrical Engineers at Toronto, Can., April 9, 1911, by William S. Murray, electrical engineer of the New York, New Haven & Hartford. Mr. Murray tells of his study of the four types of locomotive service, namely, passenger express, passenger local, freight, and switch engines, and how they were replaced by electric power. He also compares the train minute delays in December, 1908, and in December, 1909, showing how the electric service has improved. A tabular summation of train delays is given for six months in 1908 and 1909, showing the superiority of electric over steam service in this respect. April 14, page 907.

Mallet Locomotives for the Chicago, Milwaukee & St. Paul. A description of twenty-five 2-6-6-2 Mallet compound locomotives, recently built by the American Locomotive Company, whose special feature is a separate exhaust for each low pressure cylinder. April 21, page 942.

Mallet Locomotives Built and Under Construction. A table giving the number of Mallet locomotives, the railways for which they were built and a few of their important dimensions, which was compiled from data obtained from the American Locomotive Company and the Baldwin Locomotive Works. The total number of these locomotives built by these companies is 539. April 21, page 954.

Locomotive Building During 1910; Baldwin Locomotive Works. An article of 4½ pages on the important features in locomotive building during 1910 as developed at the Baldwin Locomotive Works. It was a year of development of previous designs rather than the introduction of radically new features. The rebuilding of Mallet locomotives from old power and the increasing use of the Mikado engines are of special interest. The article closes with the prediction that further development will be towards increasing the locomotive efficiency and the improvement of details. April 28, page 993.

Air Brake Indicator. A description of the Snyder air brake indicator which operates a pair of arms on the caboose, thus giving the engineman visible assurance of the condition of the train air brake line. April 28, page 1002.

Letters to the Editor.

THE EFFICIENCY ENGINEER AND BELTING.

New York, April 25, 1911.

To the Editor of the Railway Age Gazette:

In referring to the economies which they have effected, the efficiency engineers point with pride to their achievements in reducing the cost of belt maintenance. It would be interesting to see how far the methods for which they claim success would apply to railway shop practice. The accompanying illustrations show a set of belt forms used by a prominent efficiency engineer. Fig. 1 is a belt repairer's time card. Fig. 2 is a belt tickler memorandum, or a day's work prompter issued by the planning department. Fig. 3 is a daily report of belt repairing, dressing, etc., for the plant, and Fig. 4 is a life history of each individual belt.

These forms tell their own story of the clerical and mechanical complexities introduced by the efficiency men for the purpose of saving time and money. A record such as these forms demand must be complete and accurate in order to be of any value. The difficulties which attend a careful keeping of these records can best be appreciated by anyone who has tried to determine with fair accuracy the item, tension in pounds, before and after tightening, with the portable apparatus devised by the engineer.

It is perhaps needless to say that any thinking man thoroughly believes in and supports the study and the shop efficiency. But when such study results in an infinite amount of efficiency ham-

OUT / IN		ORDER No. / MAN'S No.
TIME AL'W'D	TIME TAKEN	MAN'S NAME
BONUS	RATE	IF JOB IS NOT FINISHED SCRATCH OUT THIS ☞ F
PAY FOR	WAGES	IF JOB IS FINISHED SCRATCH OUT THIS ☞ NF

BELT SYMBOL	TENSION BEFORE TIGHTENING (POUNDS ON EACH SPRING BALANCE)	TENSION AFTER TIGHTENING (POUNDS ON EACH SPRING BALANCE)	INCHES TAKEN OUT OF BELT	WORK TO BE DONE ON BELT AND MATERIALS TO BE USED	TIME TAKEN

ENTERED IN: PAY SHEET	COST SHEET	BELT RECORD

THE ABOVE BELTS HAVE BEEN ATTENDED TO AS STATED.

SIGNED BY FOREMAN OR HIS REPRESENTATIVE _____

BELT TIME CARD

Fig. 1—Belt Repairman's Time Card.

pering, instead of efficiency promoting detail, there certainly seems to be no need of introspective study on the part of the engineer. The recent violent and sweeping claims made by some of these men regarding railway practice can hardly be regarded in a serious light until the tools used by the engineers themselves become more practical.

Another illuminating example of efficiency engineer methods is furnished by the usual setting of tasks by means of a time study with a stop watch. In these remarkable analytical calculations, results which are obtained with a split second stop watch are carefully compiled by the efficiency engineer, who then determines the task by adding to the result thus obtained an arbitrary figure, say 15 per cent. for the human equation, etc. In practice the arbitrary percentage which he uses, and which is based on guesswork or judgment, usually differs with each job or piece of work. Afterwards this task is rigidly adhered to as an exact mathematical basis on which to figure operators' earnings. In other words, an exact figure in decimals is combined with a guess, and the result is accepted as a standard. Yet that same engineer would not multiply three place decimals and expect to get a result [illegible] for more than three places.

BELT TICKLER MEMORANDUM.

MAXIMUM TENSION _____ POUNDS ON EACH SPRING BALANCE BELT GREASE TO BE USED _____

DATE TO BE TIGHTENED			DATE TO BE CLEANED AND GREASED			DATE TO BE			DATE TO BE		
MONTH	DAY	YEAR	MONTH	DAY	YEAR	MONTH	DAY	YEAR	MONTH	DAY	YEAR

Fig. 2—Belt Tickler Memorandum Furnished by the Planning Department.

The writer's experience is that a force of rather good mechanics and foremen becomes a force of very poor detail clerks when they attempt to satisfy the data demanding mania of an efficiency engineer. There is good authority for the fact that in the year 1909, a shining example of efficiency engineering frequently quoted during the past few months, had more clerks, time-study men and planning-department employees than operatives in the shop.

AN EX-TIME-STUDY EXPERT.

BELT REPORT — MONTH — DAY — YEAR

SHOP	MACHINE NAME AND NUMBER	SINGLE OR DOUBLE	STRAIGHT OR CROSSED	WIDTH	TENSION BEFORE TIGHTENING	TENSION AFTER TIGHTENING	AMOUNT TAKEN OUT	HOW FASTENED	TIME WORK TOOK

Fig. 3—Daily Record of Belt Repairs.

BELT RECORD.

LENGTH OVER PULLEYS _____ BELT GREASE TO BE USED _____
WIDTH _____ THICKNESS _____ BELT DRESSING TO BE USED _____
CROSS SECTION IN SQ. IN. _____ MAX. VELOCITY _____
WEIGHT PER SQ. FT _____ MIN. VELOCITY _____
DIAMETER OF DRIVING PULLEY _____ MAX. TENSION _____ } ON EACH SPRING BALANCE
DIAMETER OF DRIVEN PULLEY _____ MIN. TENSION _____ }
HOW FASTENED _____

KIND OF BELT _____

SINGLE	TRIPLE	1 PLY	3 PLY
DOUBLE		2 PLY	4 PLY
STRAIGHT		QUARTER-TURN	
CROSSED			

DATE PUT IN USE _____
DATE TAKEN OUT _____

MAKER'S NAME _____
LIFE OF BELT _____
COST OF BELT _____
COST OF MAINTENANCE _____
TOTAL COST _____
COST PER YEAR _____

DATE RE-TIGHTENED	TENSION IN LBS. INDICATED BY EACH SPRING BALANCE: BEFORE TIGHTENING	TENSION IN LBS. INDICATED BY EACH SPRING BALANCE: AFTER TIGHTENING	AMOUNT TAKEN OUT	DATE TENSION AGAIN SHOULD BE TAKEN	DATE CLEANED AND GREASED	DATE TO BE CLEANED AND GREASED AGAIN	DATE DRESSING PUT ON DURING SERVICE	GENERAL REMARKS ABOUT WORK DONE ON BELT, CONDITION OF BELT, ETC	WORKMAN'S NAME	MAN'S TIME REQUIRED TO DO THE WORK	COST OF WORK

Fig. 4—Individual Belt Record.

INSTRUCTION OF WORKMEN AND APPRENTICES.*

FIRST PRIZE.

BY H. S. RAUCH.

Apprentice Instructor, New York Central & Hudson River, Oswego, N. Y.

It is not the intention to describe any specific course of instruction for workmen or apprentices, but to deal with the subject in a general way and try to make some suggestions, which, during six years' experience as an instructor of workmen and apprentices, have been found invaluable. The instruction of workmen and apprentices must, to a large extent, be individual; therefore, in making an analysis of the essentials of such instruction, we find: *First,* that we must know the student. *Second,* that we must gain his confidence. *Third,* that the student and instructor must have a mutual understanding that they are partners in a business proposition and that each is working for a common goal, which we will call 100 per cent. efficiency.

The first requisite for successful instruction is a knowledge of the student. In order to gain this knowledge the inspector must be a student of human nature; he must be able to size up his man at a glance, or at most by passing a few pleasant words with him, else he is liable to antagonize the student at the start and lay the foundation for failure, or for a condition that will take much valuable time to correct. No man, however ignorant, would pretend to get 100 per cent. efficiency out of a machine with which he was not thoroughly familiar. Then why should we expect to get this efficiency out of the greatest of all creations, the human being, if we do not thoroughly understand him before suggesting any improvements.

This leads to the point where the instructor must gain the confidence of the student. It is not always an easy matter to do this, but it can usually be done by finding some subject in which he is deeply interested. This requires some tact and study, and when the subject is found, the instructor must interest himself in it by asking questions and allowing the student to become the instructor in so far as this particular subject is concerned; it will be surprising how soon the student will become interested in the subjects uppermost in the instructor's mind, and a confidential relation be established. To maintain this relation it remains for the instructor to give a square deal in every case; be square with the company and square with the student; show the student that you are his friend at all times in or out of the shop; encourage his confidence at every opportunity; give him the best advice at your command, even though it is necessary for you to go out of your way to obtain it, and it has no application to the work whatever.

I will go farther and say that it is the duty of an instructor to know, to a great extent, what his students are doing with their time outside of the shop hours. This is especially true in the case of apprentices. These young men are just budding into manhood, are at the most receptive and impressionable age and they need a balance wheel. If the instructor finds that their time is not always spent to good advantage, that they frequent questionable places, it is his duty to use his best efforts to set them right.

This is a delicate subject to handle at any time. It has, and is being handled successfully, but only where the instructor knows his man thoroughly and has his confidence. Then a man to man talk, with a few examples of what the habits in question lead to will, in many cases, make the best of citizens out of those who might have been otherwise. This may look like sentimentalism, but it is business from the ground up. Where can any business succeed without the confidence of its patrons; or where can any man or mechanic give the best service to his company, or to the community in which he lives, unless he is a good citizen.

*Submitted in a competition on the instruction of workmen and apprentices which closed April 15, 1911. Mr. Rauch was awarded the first prize of $35.

WHAT SHALL WE TEACH?

The writer would suggest the following subjects in the order in which they are given:

First.—Character, by setting a good example and using your best efforts to have it followed.

Second.—Self preservation, by instructing in the proper way to handle the ordinary tools and machinery found in the shop, the proper method of shifting belts, safe-guarding gears, saws, etc.

Third.—Loyalty, by being loyal to the company's interests, and to the company's institutions; by teaching that a railway company is a commercial enterprise which has something to sell and is also a large buyer, and if through public sentiment and unjust laws a company is forced to sell at a reduced price, it must pay less for what it buys, or buy less of it; and that a large percentage of that which railways purchase is labor which is what the apprentice and mechanic have for sale. In other words, teach every man to be a "booster" for the company with which he is connected.

Fourth.—Conservation, by teaching the most economical method of manufacture; how to cut sheet metals with the least waste; how to reclaim scrap materials; to save bolts, nuts and washers; how to make a machine do a maximum amount of work with a minimum amount of stress; that the company furnishes oil, waste and wrenches for keeping machinery oiled, cleaned and properly adjusted. How to conserve human energy by cutting down the number of false movements. In short the best and most economical way to do all classes of shop work, not only from the view-point of the mechanic, but from the broader view-point of the foreman and superintendent.

In addition to the shop work instruction, which by the way usually shows immediate and lasting results, I would suggest courses in mechanical drawing, using actual machine parts for models and eliminating geometrical drawing as much as possible, introducing it only as needed, then only a sufficient amount to cover the case in question. Courses in practical shop mathematics, introducing such problems as are met with in every day shop practice. A short course in English so far as it is necessary to enable the student to render intelligent reports and to carry on intelligent correspondence; for who among the heads of departments in railway service has not been driven almost to the point of hysteria through the reception of reports that did not report anything, and correspondence that was unintelligible.

In the large and medium size shops instruction of this character can easily be carried on, as men who are capable of work of this sort are usually available and the field is large enough to permit of their making a study of, and devoting their whole time to it; but in the very small shops and engine houses a different proposition is presented. This could be taken care of in one of two ways; either by having an instructor from one of the larger points make regular calls at these small places for the purpose of instruction in class work, with a local man giving part of his time in connection with other duties to the shop end of the work; or the class work might be carried on through correspondence, although the former method would undoubtedly be productive of the best results.

TIME FOR CLASS INSTRUCTION.

The time for class instruction of apprentices should unquestionably be the day time, preferably the first two hours after checking in in the morning. At this time they are clean and fresh and their intellects clear and more receptive. In addition to the class instruction, which is given on company time, the apprentices should be required to do a reasonable amount of home work, usually mathematics dealing with shop problems. This promotes the study habit which is a valuable asset to the man and to the company in after years.

For shop men, other than apprentices, evening classes have been found a valuable adjunct and it has been the writer's experience that the hour and one-half immediately after shop closing time is best, as the attendance at that time has in most cases

proved better than is the case when classes are held later in the evening. The benefits, where classes of this kind have been held, have been both immediate and permanent, as the men in most every case show an increased interest in their shop duties.

THE INSTRUCTOR.

The instructor, as stated above, must be a keen judge of human nature, a man who is deeply interested in boys and young men, capable of taking a brotherly interest in their sports and pastimes as well as in their work; he must be clean morally, just, impartial and honest; he must be a disciplinarian in the broadest sense, firm and fair; must ask nothing but what is possible and right, then insist on getting it. In addition to this he must have patience and ability to instruct and be capable of placing himself in the position of the student in order to put the subject before that student in an intelligent and understandable manner. In short he must be able to think with them, feel with them and know their ambitions.

No man can be truly successful as an instructor, either in the shop or the class room, no matter how thorough his technical and theoretical education may have been, unless he has worked as they work, sweated as they have to sweat; knows their likes and dislikes, their desires and emotions; and through this training is able to feel with them in their joys and in their sorrows, thus winning their friendship and their confidence, which is the most valuable asset any instructor of men and boys can have.

METHOD OF INSTRUCTION.

It has been found that demonstration through the use of models is the best method to insure a thorough understanding of the subject by the student. In teaching the principals of the gear, the screw, the lever, the inclined plane, valve motions, air brake apparatus, etc., working models have been found invaluable. Printed lessons issued should be in loose leaf rather than in text book form, as the loose leaf method enables the students to make as much progress as possible individually without regard to what the others in the class are doing. In an educational scheme, as outlined above, where it is intended to do the greatest good to the greatest number, it is essential that the dull, plodding boy and the mediocre be taken care of as well and as thoroughly as their more brilliant and favored brothers.

RAILWAY CLUBS FOR YOUNG MEN.

As an aid in carrying out many of the features of the foregoing, the organization of a local railway club has been found to be most important. An organization of this kind has been in active operation for the last four years. During that time its membership has increased over 400 per cent., with a proportionate increase in interest taken. This club is officered and conducted by young railway men. Papers are prepared and read by them; entertainments and excursions are planned and executed. The members hold debates and make addresses on railway subjects, all of which broadens them, gives them confidence in themselves and is in itself a training for good citizenship.

The club library is kept stocked with the best general and railway literature; the members become readers and are posted regarding current railway events, all of which has a healthy and beneficial effect on the character of the young men. They absorb the spirit of doing great things, a door of wonder is opened up to them and they become ambitious to forge ahead to make history repeat itself and to become not only the cog of a wheel, but the wheel itself.

Just previous to writing this article, a canvass was made among the apprentices at our shop for the purpose of finding out just what the sentiment was regarding the instruction which they were receiving. They were unanimous in the opinion that they would be better mechanics, that their chances for advancement were being increased and that they were capable of rendering a higher class of service, that their earning power was greater and that their condition in life would in every way be benefited through the training which they are receiving as apprentices.

ENGINE HOUSE KINKS; ERIE RAILROAD.

SECOND PRIZE.

BY H. L. BURRHUS,
Assistant to General Foreman, Susquehanna, Pa.

REMOVING TENDER TRUCK BRASSES.

A special kink, which is useful in removing tender truck brasses, is shown in the photograph, Fig. 1. It not only saves the time which is required in looking for blocking on which to place the jack, but also holds the wheel to the rail, as the lip on

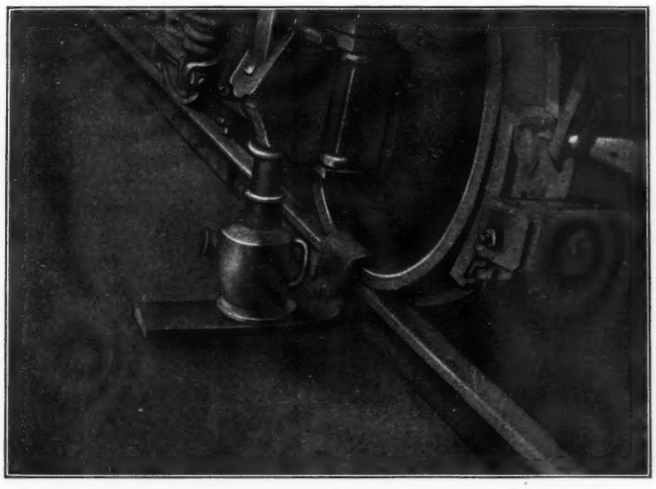


Fig. 1—Jacking Up Journal Box Preparatory to Removing Brass.

its end fits over the tread of the wheel. Occasionally the wheel will tip up if a device of this kind is not used, due to the weight on the other end of the axle. The tool has been used successfully on soft ground where ordinary blocking would sink in. It can be made of any size iron, but for good results it is best to use a piece of 1-in. x 5-in., about 14 in. long.

FRONT END CRANE.

A handy and inexpensive crane for lifting steam chests and covers, cylinder heads, pistons and front end work is shown in Fig. 2. The arm is made of a 6-in. I-beam taken from an old brake beam. The upper part of the beam forms a runway for a roller from which the hoist is suspended. The inner end is clamped to the top of the smokestack, as shown. The clamp may be made of any length to suit the height of the stack. In adjusting it, the crossbar, X, is tipped up and dropped down through the stack. As

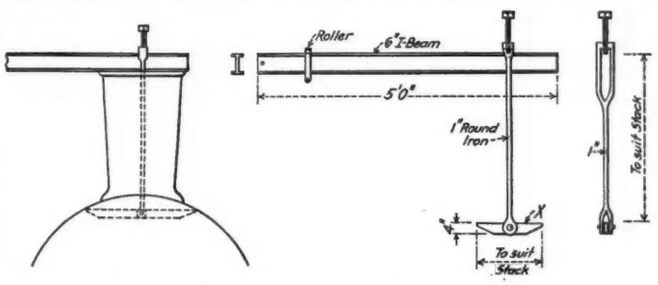


Fig. 2—Simple Crane for Front End Work.

it is evenly balanced, it takes a horizontal position after it has dropped through the stack. The beam can then be applied and be clamped in any position by the screw at the top. While the device is light enough to be handled easily, it is sufficiently strong for the work which may be required of it. In removing the crane, the screw is slacked off and the I-beam is taken out. The clamp is then lowered sufficiently so that with the use of a long stick the piece X can be tipped and be drawn up through the

stack. An important feature of the crane is that the beam is placed high enough above the work, so that the tackle blocks do not come together.

TRUCK FOR MOUNTED WHEELS.

In the different collections of kinks which have been published in the *Railway Age Gazette* there have been two or three trucks for handling mounted wheels in the shops and engine houses. The one shown in Fig. 3, however, differs considerably from any of these. A piece of 10-in. channel forms the floor of the truck, the flanges of the channel projecting upward. The wheels are loaded by placing the ends of the wheel sticks over the flange of the channel and under the journal; the flanges of the channel keep the wheels from rolling off. The large wheels are 10 in. in diameter and the treads are 2 in. wide. The two small wheels at either end of the truck keep it from tipping and catching when the load is not evenly balanced. The truck has been used successfully over soft ground and on uneven floors, and, in addition to handling mounted wheels, may also be used to advantage for transporting other heavy parts.

TELESCOPIC AIR JACK.

A telescopic air jack in a drop pit in the engine house permits the use of a comparatively shallow pit which is of considerable advantage in that it is more handy to work about and also less dangerous. A jack which has been used for this purpose is shown in detail in Fig. 4. The wheels of the truck on which it is supported are 18 in. in diameter, the general arrangement of the truck being clearly shown on the drawing. The piston is 17 in. in diameter. After it has reached the top of the cylinder the inner cylinder starts to rise and the stroke of the piston is thus practically doubled.

KEEPING TRACK OF ENGINES IN THE HOUSE.

A good arrangement for keeping track of the exact location of an engine after it is placed in the engine house is shown on the accompanying form. It should have the same number of spaces as there are stalls in the house. When the hostler brings an engine in the house he must write the engine number, the

Stall. No.	Engine. No.	IN.		OUT.		REMARKS.
		Date.	Time.	Date.	Time.	
1.						
2.						
3.						

time in and the date, on the blackboard on the line opposite the stall number where the engine is placed. The foreman can then fill in the time that the engine is to be called, or under the column headed "Remarks." can show any special work that is to be done on it. If all the work is completed before the engine is called, he marks it O. K. Any person interested can readily see the condition of every engine in the house by looking over the board. It also enables the workmen to find the engine on which they are to work quickly. If the engine number is not shown on the board, they will know positively that it has not yet been placed in the house, and that it will be useless for them to waste time in looking for it. As soon as the engine has left the house, the foreman or some person with the proper authority can erase the information, indicating that the stall is empty and ready for another locomotive.

ENGINE WORK REPORTS.

An important feature of a good engine house organization is the use of the individual engine work report book. This should be kept in a small box or holder in the engine cab, provided exclusively for the purpose, and should be used only by the engineer who is running the engine. The book should have

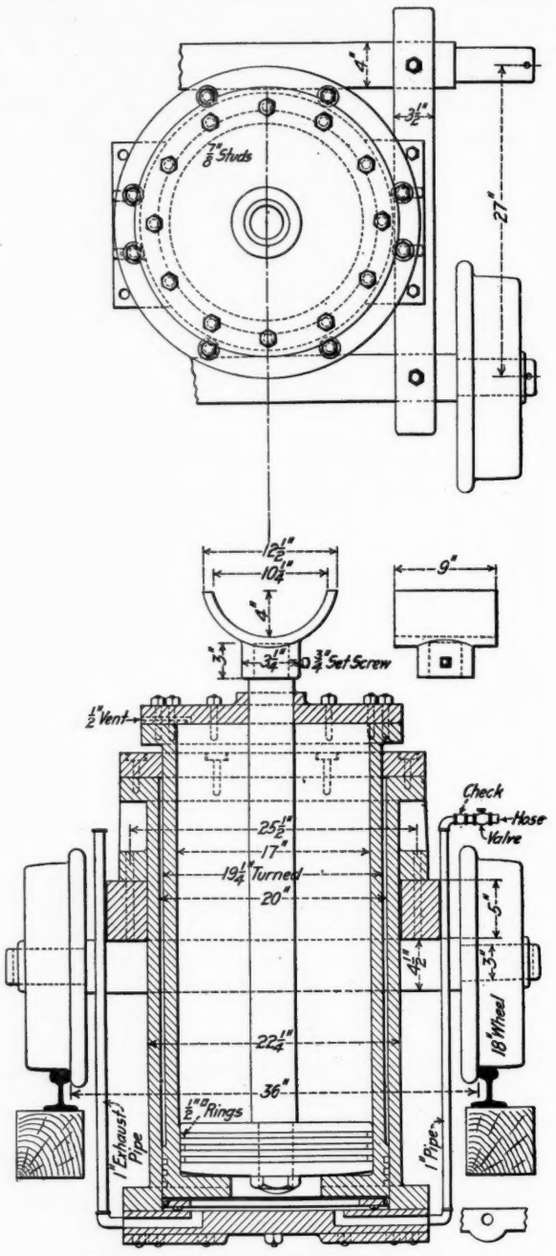


Fig. 4—Telescopic Drop Pit Air Jack.

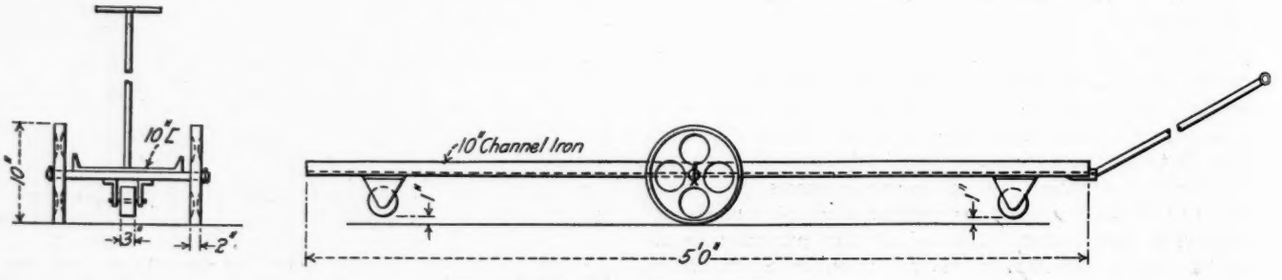


Fig. 3—Truck for Mounted Wheels.

duplicate or carbon sheets, and the engineer should fill out his work report as soon as he discovers anything wrong. Quite often the train must be stopped on the road, giving the engineer a good opportunity to inspect the engine. He may notice some repair that should be made. but too often trusts to his memory to report it on his arrival at the terminal, and sometimes forgets it. If he immediately makes a note of it in the report book there will be no trouble of this kind. Again, if the engine is due at the terminal after dark, and the engineer has an opportunity to inspect it on the road by daylight late in the afternoon and to make out his report at that time, he will make a much closer inspection and his report will be more accurate.

Another advantage is that where engines are not assigned to regular engineers, any engineer that is called to take an engine out can look over the report book and see just what the troubles on the previous trips were and thus be forewarned. By always having the work report book on the engine, any information concerning its performance can be obtained quickly, thus saving the time of checking over a great number of work reports. When an engine arrives at the engine house, the work report should be taken from the cab by the leading inspector or the foreman of the ash pit, and be given to the roundhouse foreman, thus enabling him to get a check on the kind and amount of repairs that will be required, and also assisting him in assigning the engine to the pit in the house where this work can be most advantageously done. This one point alone is quite important and eliminates a great deal of unnecessary transferring of engines after they have been placed in the house.

REMOVING DRIVING BOX CELLARS.

A handy tool for removing driving box cellars is shown in Fig. 5. Often a cellar sticks tightly and it is a difficult job to get it out. By hooking the lug X into the cellar bolt hole and using

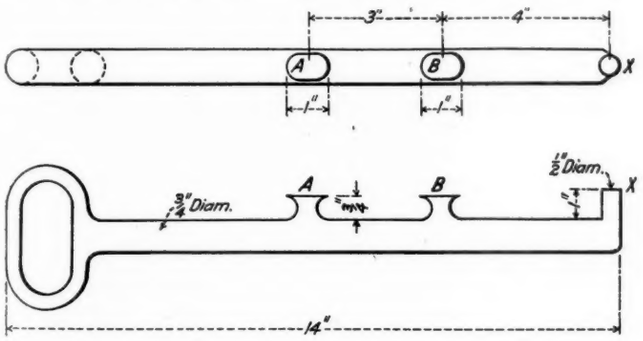


Fig. 5—Tool for Removing Driving Box Cellars.

the points A and B on the tool as fulcrums for a small bar, the cellar can be pulled out quite easily. The tool may also be used to advantage for stirring up or pulling the old packing out of the cellar after it has been removed. It is made of soft steel and the handle can be of any convenient size.

FOREIGN RAILWAY NOTES.

A direct through freight service by railway has been inaugurated between Vladivostok on the Pacific ocean and Odessa on the Black sea.

One end of the Loetschberg tunnel is at Kandersteg, in the Bernese Oberland, Switzerland, the other at Goppenstein, 17½ miles from Brigue, and about 18½ miles from one portal of the Simplon tunnel. The approach line on the south side, from Brigue, to Goppenstein, runs mostly along a steep mountain side above the Rhone valley. In its course it passes through no fewer than 21 small tunnels, as well as over ten viaducts and several very high bridges. Besides all this, protection works have had to be erected in several places to guard against avalanches.

EFFICIENT SHOP MANAGEMENT.

BY DAVID VAN ALSTYNE.

Vice-President, Allis-Chalmers Co., Milwaukee, Wis.

Maximum output, lowest cost of production and highest wages can be accomplished through the accurate knowledge of what every detail of the business actually is, the determination of what it should be and the bringing of the actual to the standard and keeping it there. The higher the efficiency, the lower the unit cost and the higher wages the employer can afford to pay as compared with competitors.

The measure of the efficiency of an organization is the extent to which the enthusiasm of the individuals in it is maintained through the organization and not through the personality of the man at the head of it.

Not the least asset created by the management which has accurate record of the individual, is the impression made upon the employee that the highest officials know of him personally; that he is less subject to the whims and prejudices of his immediate superior, and that he is recognized as an essential part of the organization, which arouses an enthusiasm that cannot be too highly valued. The treatment of men like machines by dealing with them as a class and treating good and bad more or less alike creates indifference and antagonism, and is the necessary result with conventional management. The organization created by this control of details is of vastly greater importance than the facilities or equipment. The good organization will obtain good results with poor equipment, but the poor organization will obtain poor results no matter how good the equipment may be.

Management through control of details takes advantage of the fact that few men know how to work efficiently and few employers know definitely what they should expect of their employees or from their money otherwise expended. Some employees take advantage of the ignorance of their employers by doing even less than they know they could do. Time and material are wasted in an infinite number of ways and the efficiency is limited by the personal attention of those who are in charge are able to give to the comparatively few details coming under their notice.

Under detail management an investigation of the possibilities of each operation and each pound or foot of material is made and a standard set per unit of output. These investigations are made and the standards set by experts, each in his own line. Records giving a continuous comparison of each detail of labor and material with its standard indicate which are satisfactory and which need attention. The value of establishing a standard or measuring stick for every detail cannot be overestimated. It not only gives the manager a feeling of security in his knowledge as to exactly how his affairs stand and as to what needs his concentrated attention, but also gives his subordinates something definite to work for and arouses their enthusiasm, especially when extra pay is given for reaching the standard. Men do not object to hard work if they are well paid and contented, and the harder they work within reasonable limits, the more contented they are.

It may seem that the expense of such details will not be justified by the results, but this argument is not used very long after the effort is made. The results are usually beyond expectation, and the returns frequently as high as one thousand per cent. on the investment necessary to obtain them. It is probable that the profits of the average railway or manufacturing concern can be increased from 25 to 100 per cent.

The fundamental principles in reaching high efficiency are as follows:

First, Records.—An accurate record of each detail, or group of details, of labor and material. A record should be looked upon

Abstract of a paper presented before the Congress of Technology at the Fiftieth Anniversary of the granting of the charter of the Massachusetts Institute of Technology.

as a working tool and its value measured by its capacity for producing lower cost and greater output.

Second, Standardized Conditions.—This involves putting the equipment into such condition as will make maximum output and most economical operation possible.

Third, Standardized Quality.—The determination of a standard of quality of output or efficiency of service below which it is not permissible to go is necessary because efforts to reduce cost and increase output may result in lowering the quality unless systematically prevented.

Fourth, to find out what is to be done and how to do it.—This involves stripping the work of all unnecessary refinement, finish, material and operations, bearing in mind that what is worth doing at all is worth doing well enough for its purpose and not a bit better, and then determining the simplest and quickest method of doing it with the facilities at hand and establishing a time or cost limit.

Fifth, written instructions as to the standard method of reaching the required time or cost.—Such instructions constitute a textbook of the business and are not to be deviated from. Employees should be constantly checked on their knowledge and close observance of instructions; otherwise the instructions are rarely fully understood and are quickly forgotten or ignored.

Sixth, constant comparison of actual performance with standard to see that the actual reaches the standard and continues there.—It is not essential that allowances, standards or ideals should be ultimate or represent the highest state of the art; in fact such standards may appear to be so hopelessly impossible of attainment as to be undesirable for present purposes. The standard should be set as far ahead of present practice as is practicable. The essential thing is to see that whatever ideals are set, are reached, and that, as long as they are not changed, there shall be no falling away from them.

This is the principle which is most neglected by managers and in which ordinary management fails. It is easy to establish rules and standards, but it is not easy to have them lived up to continuously. Unless the organization provides for comparing in detail what is done with what should be done, with mathematical accuracy, a high efficiency cannot be maintained. It is a common experience for a concern to reach a good efficiency during dull business and to drop to a low efficiency during heavy business because the management has so little control over details.

These principles are a decided recognition of the capacity of the individual and may be considered antagonistic to some of the expressed principles of organized labor. Restriction of output (which is not the policy of organized labor, but is their tendency), opposition to piecework and premium or bonus systems of paying for labor, and the limitation of the number of apprentices are not economically correct and nobody realizes it more than the more intelligent union men; but they constitute correct policy from the union point of view, because they are among the few weapons labor has with which to fight and defend itself against aggressive employers. Under usual conditions they are necessary to the existence of organized labor. So long as employers consider it necessary to oppose organized labor, just so long these weapons will be used to the detriment of the employers. If, on the other hand, it should be considered safe to work with organized labor the men soon get the employer's point of view, and he theirs. Each sees that the other is right, and they adjust their differences by making an agreement.

The usual form of trade agreement which binds the employer to pay fixed rates per hour, day or week and the employee to put in his time and produce whatever the employer is able to get out of him, is economically wrong because one-sided and indefinite. Each has his opinion as to what constitutes a fair day's work, which the employer will constantly try to increase and the employee tend to decrease. What one employer may consider a fair output may be too little for another employer and more than required by a third. It is to the interest of both employer and employee to agree on a reasonable time for each operation, so that each may know definitely what he is to expect from the other. An agreement which binds the employee to a definite output as well as the employer to definite working hours, rates of wages, etc., is a safeguard for both parties. To whatever extent the employer is liberal in his treatment of men, they will usually meet him half way. The agreement is a protection to the employer, in that it reduces petty injustices on the part of minor officials and also prevents local troubles from men widely distributed, but bound by the same agreement, as in the case of railways. A large percentage of the restrictions which unions try to add to their agreements from time to time are an effort to check abuses by minor officials, who are too narrow to see any but their own side and are over-zealous in the interest of their employers. Labor has learned its bad tricks from employers and in using them has been a great educator of employers in making them see that there are two sides to even the labor question. There is much to be said, however, in justification of those employers who refuse to deal with organized labor because of the unscrupulous methods of some labor leaders.

Laboring men are by inheritence and training suspicious of employers and inclined to take a sentimental view, to brood over their down-trodden condition. Whenever they can be persuaded to take a business-like view of affairs, to determine what is to their interest and whether it is to their ultimate interest to consider the interest of the employer, they at once become rational, and there is no difficulty in coming to terms with them.

Whenever the employer can create the feeling that the sole object of his official existence is to get the most out of his employees for the money invested in them, and that he realizes this can be done only with the best paid, most thoroughly contented employees, he has won his point and need waste no further effort to destroy unionism. He will find that he has accomplished all that is necessary or desirable in modifying radical unionism, and that it is as much appreciated by employees as employers. Every union man, like all other individuals, is primarily interested in his own welfare and is interested in his union or his employer only to the extent he thinks each contributes to his welfare. Whichever impresses him as most profitable for him to adhere to will receive his loyalty and support.

During the recent period of great commercial activity many complaints were heard of the difficulty in getting skilled men, many employers claiming that the unions were making men indifferent and independent, and through various restrictions preventing the development of a sufficient number of skilled men to supply the demand. I am inclined to think that to a certain extent this may have been true and that it was largely the fault of the employer for permitting it. The influence of the unions, however, in this direction is limited and only indirectly the result of their efforts to better their conditions. The chief cause of the scarcity of skilled labor is the extreme fluctuations in business, creating at one time an abnormal demand and at another throwing both skilled and unskilled labor out of work. There are more skilled men and there is skill of a higher order than ever before; but by the nature of things their number is more or less adjusted to the average demand. There is always available a nucleus of these good men who have comparatively steady work, and during times of extreme activity the only men available are those who spend a considerable portion of their time in idleness. In times of great activity there is no good opportunity to train this generally unemployed increment and in dull times idleness encourages laziness, indifference and a loss of the little skill men acquire while at work. We are inconsistent in throwing as many men as possible out of work as soon as business begins to decline and then complaining that they are not capable of the highest efficiency when they are employed.

This is the greatest evil for which our present social system

is responsible, and it is also the most difficult to regulate. Apprenticeship, trade schools and like efforts to train skilled workmen are all good to a certain degree, but their influence is insignificant as compared with the influence of long periods of enforced idleness to which the laboring class is subjected. It is important to develop skilled workmen, but it is of much greater importance to develop loyal American citizens who are interested in promoting the welfare of the state and consequently that of the employer. It is out of such employees that the employer makes the greatest profits in the end. There is not much encouragement for a man who spends a considerable portion of his time in idleness to become either the right kind of citizen or employee.

This ever-present fear of being thrown out of work makes men hold back their output in order to make the work last as long as possible. Aside from the inhumanity of periodically depriving a considerable percentage of our citizens of the means of earning a living, it would seem good business policy in the long run for employers to find some way to keep a large percentage of their employees on the pay roll at at least a living wage during periods of dull business, whether there is work for them or not; and it is probable that a great deal more could be done in this direction than is done. It is to be hoped that some day it may be found practicable for the law to require employers to take care of a certain portion of their idle employees during periods of depression, and the government to give employment to the rest on public improvements.

It is encouraging to note the number of concerns which are introducing old age pensions, profit sharing, etc. It is to the pecuniary interest of the employers to do these things themselves rather than to wait for them to be done by the government with its inevitable inefficiency. Every large employer of labor can afford to have what might be called a sociological department, whose duty it would be to look to the welfare of its employees so long as it is not done in a patronizing manner. Such a department should keep a personal record of each employee, consisting of whatever information of value is obtainable, to be used in deciding as to desirability as an employee, and eligibility for promotion, instead of depending on haphazard opinions which are usually superficial and biased. It would also keep as closely in touch as possible with employees to find out what secret grievances they are brooding over due to brutal, prejudiced and partial treatment by superiors; and be ready to lend a helping hand in case of misfortune, sickness or death. Apprenticeship, pensions, profit sharing, prevention of accidents and hospital service might also properly come within the jurisdiction of this department.

Having in mind that the large employer will not attain highest efficiency which will continue indefinitely until he produces, as closely as possible, the personal relationship between superior and subordinate which exists in the case of small employers, it would seem that the best way to accomplish it is through a department created for the purpose. This department would, in the long run, be one of the most effective in increasing net earnings.

The speculative financial influence is a serious obstacle to the progress of better management, and, in consequence, to its own interests. Not only does it not understand the human element in its business, which is the important element with a large employer of labor, but being in control it usually dictates a narrow, opportunist sort of policy based on superficial opinion rather than scientific investigation. It cannot see that a moderate investment in better organization and management will in nine cases out of ten save a large investment in equipment, besides reducing the cost of the operation. As a result, executives, no matter how well intentioned, are afraid to depart from the narrow conventional limits prescribed; so that "big men," are not developed for the "big" positions.

Little improvement can be expected until the average board of directors takes more interest in the business it directs and becomes more intimately acquainted with the details. It would seem that one way to accomplish this would be to have each department head report direct to the board instead of through the president, who as a rule is a specialist in only one department. It would also seem advisable for the board to have specialists report on the efficient operation of all departments in the same way that chartered accountants report on the accounting department.

ENGINE HOUSE KINKS; NEW YORK CENTRAL & HUDSON RIVER.

BY H. S. RAUCH.
Apprentice Instructor, Oswego, N. Y.

PORTABLE WORK BENCH.

A portable work bench, which is different from any of those which have been illustrated in connection with previous competitions, is shown in Fig. 1. By raising the end of the 1-in. handle and placing it in the hook, the wheels are lowered to

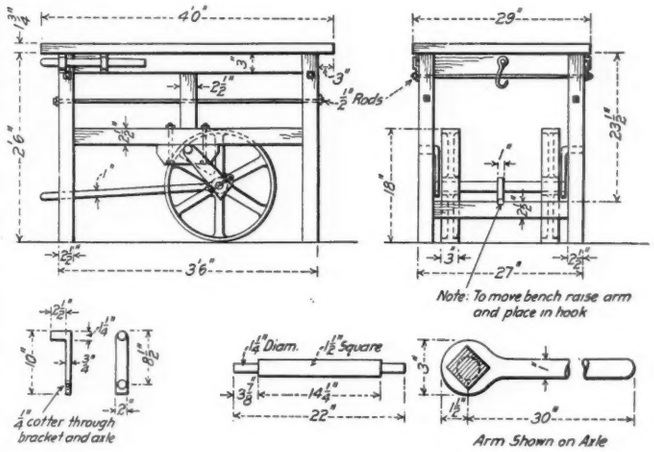


Fig. 1—Portable Work Bench.

the floor, and one pair of bench legs is raised upward. The bench can then easily be rolled to the most advantageous position for handling the work for which it is to be used. By unhooking and lowering the handle, the legs of the bench again come in contact with the floor. The construction is simple and inexpensive and provides the necessary rigidity. The detail of the brackets in which the axle fits and of the arm or handle at the center of the axle are shown on the drawing.

UNIVERSAL COUPLING.

A universal coupling, which will be found valuable in connection with a tube cutter or tube roller when operated by an air motor near the shell of the boiler, or where there are obstruc-

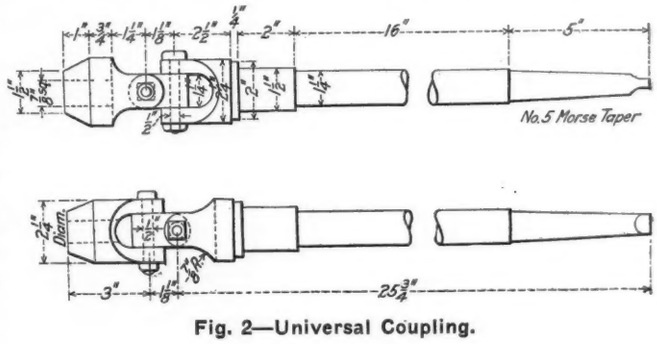


Fig. 2—Universal Coupling.

tions which prevent the motor from being placed in line with the tool which it is driving, is shown in Fig. 2. The pins in the coupling are ½ in. in diameter.

IMPROVING AND MAKING MECHANICS.*

SECOND PRIZE.

BY JOHN H. LINN.

Apprentice Instructor, Atchison, Topeka & Santa Fe, Topeka, Kan.

The Need of Mechanics.—The cry on every hand, from one end of the industrial world to the other, is the lack of competent workmen. In the struggle and competition of modern business push, brawn and muscle have necessarily given place to brains and skill. While inventions and improvements in endless succession are everywhere increasing the effectiveness of commercial enterprise, they are likewise daily increasing the demand for thinking men, men capable of performing the work incident to our rapid industrial development. The worker or artisan who labored at the bench in his own home, assisted perhaps by his son or a few helpers, has been supplanted by immense shops and manufactories with thousands of workers under a single roof. To meet these changed conditions we must have trained minds and skilled hands, not of the few but of the many. The educational forces of the country are beginning to realize that they have failed to keep pace with our rapid industrial progress and are struggling blindly for some solution of the difficulty. Meanwhile the wheels of industry will be checked for lack of operatives unless the industrial concerns themselves come to the rescue. Many of them are doing so. Nowhere is the lack of workers more keenly or more sorely felt than in the modern railway shops. I might add that nowhere is the problem being so successfully solved. The mission of this article is to tell briefly what one of these companies is doing to meet this emergency and to suggest a further solution of the difficulty.

A New Apprenticeship System.—Before touching on what may be done to increase the efficiency and happiness of the older employees, I shall discuss the education and training of the apprentices, that important class of workmen on whom the hope of the industrial future must depend. Some would tell you that the apprenticeship system is dead, but I assure you it is a very lively corpse. The old system wherein the apprentice had to depend for his instruction on his foreman or fellow workmen did almost entirely disappear with the specialization of modern industrial life, but from the germ of the old apprenticeship has blossomed forth an advanced system, which is as yet the most successful solution of this important problem.

Support of the Management.—In considering this later system it is well to note wherein the older systems failed. Too often the busy foreman, responsible for the immediate output of the shop, lost sight of the real aim of an apprenticeship course; that is, the making of skilled mechanics for the future. For this reason any scheme to be successful must have the support of the officials highest in authority, men big enough and broad enough to look beyond the immediate pay roll and shop output, and see the more vital and more lasting results to be derived later on. Although our company is spending between three and four thousand dollars each month toward making skilled mechanics for the future, the results achieved prove conclusively that the scheme is the best investment the company ever made; that the plan more than pays its way as it goes; this without taking into consideration the primary result of graduating into our shops skilled mechanics familiar with our methods and loyal to the company in the very highest degree.

Qualified Supervisor.—In addition to the unlimited support of the management, the apprentice department should be in direct charge of one having a natural love and sympathy for boys, an intimate knowledge of the training which an apprentice in each trade should receive, sufficient executive ability to properly conduct his department, and last but not least, sufficient tact to inaugurate with the least possible amount of friction the necessary changes in the handling of apprentice matters in the various shops. It has been the writer's observation that from the office boy up everyone connected with railway work is very sensitive about his prerogatives. Considerable tact and firmness is necessary to inaugurate any change which transfers duties from one official to another. This road has been especially fortunate in having a supervisor endowed with the above and other essential qualifications. To his ability and to the support given him from the management, are due the extraordinary results already achieved.

Competent Instructors.—Next in importance, is the selection of competent apprentice instructors. No expense should be spared in getting the best men available. The duties of the instructor are as difficult as they are important, as full of trials and hardships as of blessings for those whom he influences. He should not only have sufficient knowledge and skill to command the confidence of the apprentice and all with whom his work brings him in contact, but must also know how to impart his knowledge to others. He must not be a mere machine, but a living soul, obedient to the light of a cultivated intelligence and the impulses of a generous heart. He must love boys in general and have a fatherly love for the particular boys in his charge, yet be able to sympathize as one of them in their games and sports, their joys and their troubles. He must make an individual study of each boy and learn just what help each one needs and how this help can best be given. He must be exceedingly patient and self-sacrificing, showing his love and care most conscientiously towards those who need it most—not the most deserving, but the most needy. He should become familiar with each boy's home life, know with whom he associates and how he spends his evenings; remembering that if these boys are to become good mechanics and loyal employees they must also be honest and upright citizens. The instructor's success or failure will depend very largely on his own personality, on his own manner and temper, on his own life and character, on the ideals he impresses by his own spirit and example.

School and Shop Instruction.—The instruction given the apprentices should be two-fold, that which can be given in the schoolroom, and that which must necessarily be given in the shop. The shop instruction is by far the more essential and fruitful. It is the shop instructor's duty to give the boy whatever instruction he may need on any machine or class of work. He it is who decides when the apprentice should be changed from one kind of work to another. He works in harmony with the foreman. The foreman decides what work the apprentices as a whole shall do, but the instructor distributes this work among the various boys, taking into consideration the fitness and needs of each. Results have proved this a very satisfactory arrangement both for developing the boy and for increasing the output of the shop. There should be a shop instructor for every twenty-five or thirty boys. With a greater number he can look after them only in a general way.

The school instruction should be confined to subjects pertaining directly to the respective trades. There are so many things that the mechanic should know, that with but four hours a week and a course of only four years it will require every moment of the apprentice's time to master the essentials of his trade. Furthermore, a too wide diversity of subjects will only tend to lead him astray. The school instruction should be during working hours. Night schools so far as the average boy is concerned are a failure. It takes a great deal of stamina for even an ambitious man to sit down to night lessons after having worked ten hours in the shop. The boy with his immature mind and his growing body is certainly entitled to a little time for rest and play. If we wish him to be loyal, we must not deny him the pleasures and recreation of his evening hours. If education pays at all, and it certainly does, any corporation can well afford to pay its apprentices for the time spent in school, two hours a day, two days a week.

Where there are only a dozen or fifteen boys, one man (if

*Submitted in the competition on the instruction of workmen and apprentices which closed April 15, 1911. Mr. Linn was awarded the second prize of $20.

a competent one can be found) can take care of both school and shop instruction. This arrangement really has many advantages, not the least being the closer relation between the school and shop instruction. For the smaller shops we have traveling instructors who spend two days a week at each shop. Corporations not deeming it advisable to conduct the school work themselves can in many cases arrange for the local school authorities to open a special school for the employed boys of the community. But we know of no substitute for the shop instruction. In our modern shops, especially those working under any kind of individual effort system, neither the foreman nor any of the men have time or inclination to show the apprentice the many things he needs to know.

Wages Paid Apprentices.—The apprentices should be paid living wages from the start, with a slight increase as they advance in service. It is true many readers of this article served an apprenticeship on fifty cents a day. But conditions are now changed. There are now too many avenues open for the boy, many of these much more attractive to him at his critical age. In too many cases our most promising applicants must help the father provide for the home, or possibly keep the wolf from the door of a widowed mother or orphan sister. If the scheme is to be successful, we must make these boys self-supporting from the start. The amount of work they actually accomplish more than justifies paying them liberally. It is a conservative estimate to say that the average apprentice with competent instruction (which will cost less than two and one-fourth cents per hour per boy) will accomplish fully 80 per cent. of the work done by a full-paid journeyman. Upon graduation they should be paid journeyman's wages, for they are certainly worth far more to us than any other class of mechanics.

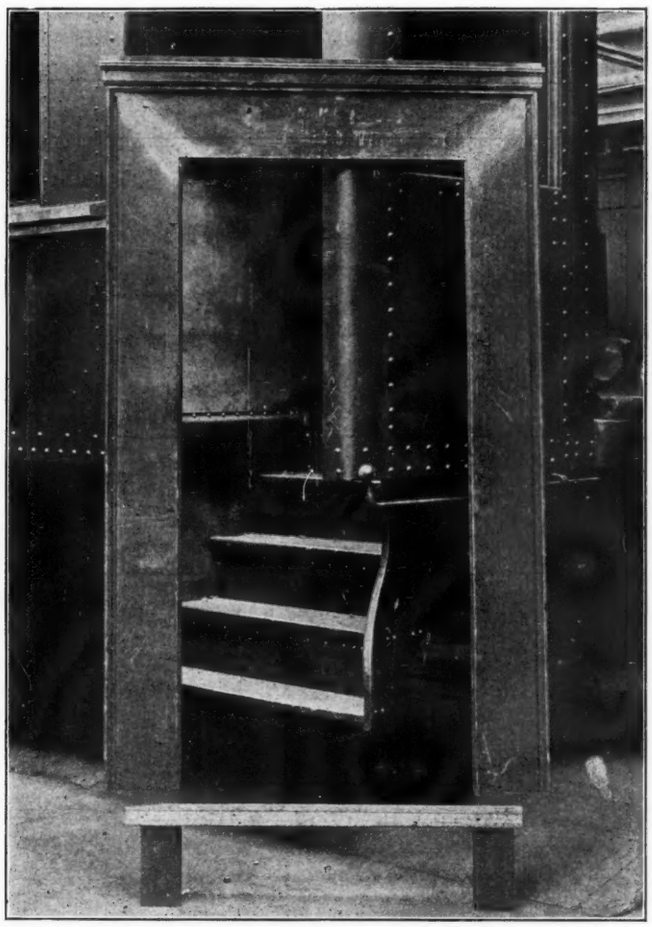
Does it Pay?—Thanks to the treatment received, over 85 per cent. of our graduates have remained in our service. These men are not only skilled mechanics, but they are familiar with our ways and means and are vitally interested in the company's welfare. Not all of them are, or will be, leaders. It is not our desire that they should. Our aim is merely to make skilled and loyal mechanics. It is a significant fact, however, that several of our graduates have already been placed in responsible official positions. Does the scheme pay? The management, the local officials, and the apprentice boy himself answer: Yes, a thousand times, yes.

Other Employees.—But what about the countless others in our service, who are beyond the age of an apprenticeship? Should nothing be done for them? Space here does not permit going into detail, but the writer believes that many features of our apprentice training could be applied with profit to the improvement of other employees. Some of the younger handymen or helpers could be encouraged to attend night school, the tuition of which the company could well afford to pay. A shop demonstrator capable of performing the various operations with the least possible waste in time and energy would be of assistance to even the skilled mechanic. In the smaller shops perhaps the apprentice instructor could also instruct some of the handymen and poorer mechanics. At least these men should receive more of the courteous treatment received by the apprentices. They should also be disciplined with a firm but friendly hand. Too often they are treated as though they were devoid of human feeling.

Any corporation will do well to cultivate a more friendly and unselfish feeling among its employees, and especially between its workmen and shop officials. The company should have a genuine interest in its men, not merely in reference to possible increased value in dollars and cents, but a real regard for their welfare as men. The treatment given them should be such that they will not look upon their employer as an aristocrat or corporation of aristocrats, their foreman as a slave driver, their machine as a treadmill, and the world at large as against them. They should be made to realize that their employer's interests are their own, that they are working for the same end, that mutual effort will bring mutual reward. When these conditions are realized we will be ready for a still greater industrial achievement.

OXY-ACETYLENE WELDING FOR STEEL PASSENGER CARS.

Oxy-acetylene welding is being used to splendid advantage in the building of steel passenger cars for making strong, and at the same time invisible joints, which have an efficiency of from 80 to 85 per cent. The great strength of the riveted joint has made it a favorite for many locations on the steel car. But even where the rivets are countersunk and the heads are filed or ground flush it is not an invisible one. Soldering is sometimes used, and at times with success. There are, however, two objections to it; it is weak, having only about 40 or 45 per cent. of the strength of the metal united, and it has a different coefficient of expansion from that of steel.

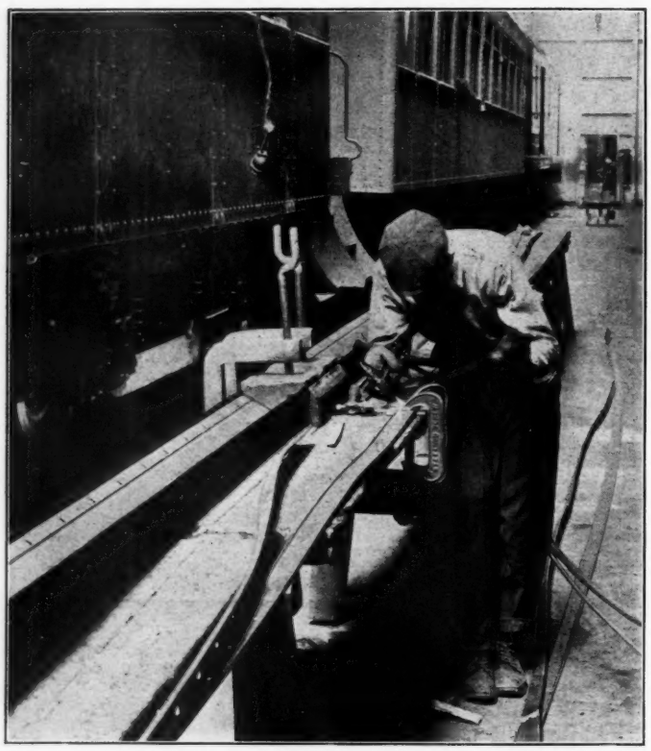


Door Frame for Steel Coach Made in One Piece by Oxy-Acetylene Welding.

On the coaches for one road the joints of the roof plates are closed by the oxy-acetylene torch. The roof joints on a standard car total about 232 lineal feet. The principal joints are transverse, extending clear across. At either end of the car is a longitudinal joint several feet in length where the right and left hood plates meet. The metal of the roof is 1/16 in. or 3/32 in. thick. A difficulty that has been met in such work is a tendency of the plates to bend downward and form a groove with the joint at the bottom. This tendency is successfully dealt with by using a small T-bar, to the arms of which the edges of the plates are riveted. The web of the T lies immediately underneath the joint. The T-bar so increases the capacity for the absorption of heat that a heavy wire, ⅛ inch thick, is employed as

a welding stick. A flat rate of 4 cents per lineal foot is paid for the labor; the gas expense is estimated at about 1½ cents per ft. The welding of the entire roof thus costs about $12.75. It is not necessary to chamfer the edges in butt-welding such thin sheets. The roof plates are about 7 ft. across. The T-bars have a metal thickness of ⅛ in., the arms are about 1 in. wide, and the web about 1½ in. deep. The acetylene is supplied through flexible tubing from an overhead ¾-in. pipe.

Another example of welding on steel coaches relates to the joints of the panel frieze. This is a flat, longitudinal panel with a molding above and below. There are three sections on one side of a car. The pieces are straight, but the joints must be such that there will be a difference when in place of ⅜ in. between the level of the center and the ends, which are 60 ft. apart, to provide the proper camber. Formerly, soldering was employed. It was, however, quite expensive, costing about $9 per car, and not so satisfactory because of the weakness of the



Welding Parts of Deck Molding Together; Eight Welds Per Car.

joint. By the oxy-acetylene process, the work is being done for $4.50 and makes a much better job. The plates are 1/16 in. thick. In making the weld, work is begun at a a point distant one-third of the total width from the side which is to be uppermost when the frieze is in final position. Beginning at this point, the upper third is welded. The camber will now be in the wrong direction. However, by beginning at the same point as before and welding the remaining two-thirds, this camber is eliminated and the correct one introduced. There are no supporting strips riveted to the frieze, the plates being held together by the weld alone. So perfectly is the joint made and the excess metal removed that it would require considerable examination to find the joints in the finished car.

Another interesting piece of work relates to the joints of door frames. It is necessary that this shall be a perfect piece of work, but it is easily and satisfactorily done by the oxy-acetylene process, as shown on one of the accompanying illustrations.

Ten door-headers for five cars were each made ⅜-in. too narrow. The old remedy would have been to tear out the frames, involving an expense estimated at $5 per door. However, a strip was successfully welded on, correcting the defect. The cost of welding and subsequent filing was estimated at 20 cents per door.

The diamond shaped window frames used on some coaches are made of 3/32-in. plate, and have four mortised joints each. Oxy-acetylene welding is employed here. Similar joints in the rectangular deck frames are also welded by the same process. In a single car, there are upwards of 176 such joints, or about 30 lineal feet of welding.

Another example of the employment of welding as a finishing procedure is in connection with the grab handles. These consist of three parts, a steel tube and two fittings. The fitting when in position has a vertical projection which is enveloped by the tube end. A counter-sunk pin is employed to hold the two firmly together. The welding process is used to efface the joint where the end of the tube comes in contact with the shoulder on the fitting. The labor cost of setting and welding these fittings is 1½ cents each, or 3 cents for each grab handle.

On certain cars, the roof sheets and the steel head lining are about 1⅞ in. apart, along the top of the roof. There are ten chandeliers per car, and the double covering made of thin material has to be strengthened at ten points. This is accomplished by inserting a box-like support in two sections in the space between the head lining and the roof at each chandelier. Each of the twenty pieces is a rather complicated sheet metal form. The upper and lower bases are shaped somewhat like the letter C in Gothic type, only they are not precisely duplicates. These are connected by a strip between the convex sides of the C's. Formerly this entire piece was formed by pressing. There were, however, a large percentage of failures through radial cracks at the bends of the C's. Moreover, it required six operations on the press. At the present time, these pieces are formed of three pieces of 3/32-in. sheeting welded together by the oxy-acetylene process. It is estimated that a saving of 50 per cent. has been accomplished by the change in method, and there are practically no failures.

In some steel cars there is a recess or alcove for the water cooler. At the bottom of the alcove, a somewhat complicated depression is made for the reception of the drinking glass. It seems to be practically impossible to form this bottom together with the depression from one piece by the use of the press. The oxy-acetylene welding process permits the pressed piece and the bottom to be united into a single piece. The bottom is also welded to the vertical part of the alcove.

Perhaps the most interesting piece of work being performed in steel car construction is the welding together of sheets to form units of head lining. The units required are about 7 ft. square. The requirements call for the use of patent level stock. Apparently this is the only steel sheeting that is absolutely flat; but it is not obtainable of sufficient width. By the use of the oxy-acetylene welding process, two strips are so united, edge to edge, that a piece of the desired width is produced without destroying the required flatness. The stock used is quite thin (about 1/16 in. thick) and no reinforcing strip is employed. It is a butt weld. In carrying out the operation, the two half-sheets are secured edge to edge on a suitable table by heavy bars properly clamped. The edges of the sheets are not prepared, but are placed in contact on one side, and perhaps ¼ in. apart on the other. The operator begins on the side where there is contact, using a No. 4 tip and 1/16-in. wire. At first, the separation of the edges opposite tends to increase. But as the work advances, they press towards each other. Two or three times during the operation the clamps on the open side are loosened and the edges permitted to approach a little. As the operator works across the 82-in. seam, a buckle follows. But this disappears as he finishes the weld. The ends of the lengths which have been joined may not form a line that is quite straight, but this is readily corrected by trimming. The surface of the weld will not be smooth, and this is remedied by filing. The expense for the labor, including the filing, is 4 cents per

lineal foot. The gas expense may be taken at 1½ cents, so that the weld costs, altogether, about 38.5 cents. The major portion of the welding apparatus used in the shop in which these operations were performed was obtained from the Davis-Bournonville Company, New York City.

ENGINE HOUSE KINKS; CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.

BY THOMAS NAYLOR.

Roundhouse Foreman, St. James, Minn.

AIR PUMP PISTON HEAD HOLDER.

One often hears an engineer coming in after an engine failure say that if he had only had something to hold the air pump piston from turning he would have brought his train in without trouble. The device shown in Fig. 1 is so simple that it hardly seems worth while illustrating, and yet many an engine failure could have been prevented by its use. Every engineer could

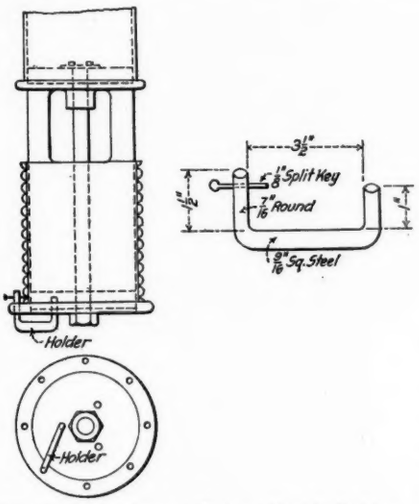


Fig. 1—Air Pump Piston Head Holder.

make one in a moment or two from an old packing hook, a large nail, or even by bending a piece of ⅜-in. wire into the form of the figure 3. The holder shown in the illustration is made of 9/16-in. square steel bent at each end as shown. A ⅛-in. hole is drilled ¼ in. from the end of the longer arm. This is for a split key to keep the holder in place, as shown on the drawing. All air pump piston heads have two or three holes in them, and by putting one end of the holder in one of these, and the other end in one of the cylinder head tap bolt holes, the piston head can be kept from turning.

APPLYING LINER TO CROSSHEAD.

A simple method of applying a lost liner to a crosshead without taking down the main rod and crosshead is shown in Fig,

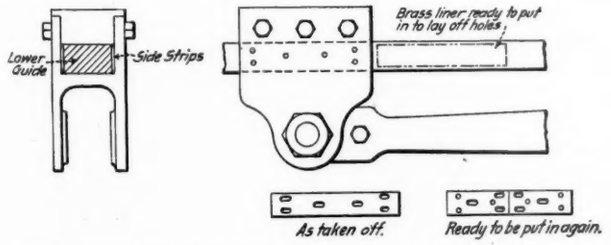


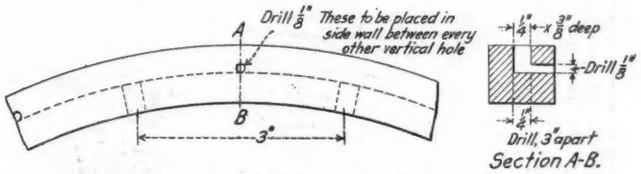
Fig. 2—Applying a Liner Without Taking Down the Crosshead.

2. The liner is slipped into position between the guide and the crosshead, and the holes are marked off. It is then removed and the holes are drilled and tapped, after which the liner is replaced and a copper rod with threads on one end is screwed into the hole and is cut off to allow ¼ in. for riveting over on the outside of the crosshead. In performing this latter operation the crosshead is wedged on the other side of the guide, so as to draw the liner, which is being riveted, close to the guide. Liners may be applied in this way in about an hour, and I have often seen them run until the engine went to the shop for overhauling. A liner that has become loose, and in which the rivet holes are elongated, may easily be used by removing it and cutting it into two pieces, as indicated on the illustration, and redrilling it as shown.

LEIGHTON CYLINDER PACKING RING.

A series of experiments are being conducted by the Illinois Central with a new type of snap cylinder packing ring, the invention of Wm. Leighton, a machinist in the roundhouse at Clinton, Ill., who has obtained patents on it in United States and Canada. The invention differs from the common type of ring to the extent that it has an annular groove in its outer edge, holes extending from the bottom of the groove radially inward to its inner surface, and other holes extending from the groove axially through one of the side walls of the ring.

Those familiar with the handling of heavy power are aware of the difficulties experienced with defective cylinder packing, resulting in engine failures, delayed trains, and time lost at



Leighton Cylinder Packing Ring.

terminals for making repairs; often the character of the material composing the ring makes little difference in the results. Excessive wear on the ring and the cylinder wall is brought about by the pressure of steam under the ring in addition to the natural spring or snap in the ring when applied. This also tends to some extent to wipe away the lubrication.

With this idea in mind, the patentee advances the following claim: The smaller bearing occasioned by the annular groove in the face of the ring reduces frictional resistance between the ring and the cylinder wall, and the holes extending from the bottom of the groove inward to the inner surface of the ring permit the admission of steam into the groove. In other words, the pressure of the steam at the bottom of the groove equalizes the pressure under the ring and produces a balancing effect, besides providing ample lubrication at all points of the stroke through the medium of the steam saturated with the oil contained in the groove. The holes extending from the groove through the side walls are optional and are placed against the pressure side of the piston head, front and back, with a view of relieving the groove in the packing ring at each exhaust and permitting the free movement of the ring in the piston head groove. Recently the above holes were omitted and no perceptible difference was noted in the results.

The management of the Illinois Central has given all assistance possible to carry out the experiments, and is well pleased with the results obtained. The standard freight engines on the division where the experiments were conducted are of the mogul and consolidation type, having cylinders 20 in. x 28 in., and carrying 200 lbs. steam. The ring has given equally good service in passenger locomotives and switching power of smaller size. The improved rings now in service have run 25,000 to 50,000 miles without any perceptible wear. In one instance—that of a passenger engine—they ran 70,000 miles

and were only removed on account of a change in cylinders due to cracked bridges.

The manufacture of this ring, as compared to the common type, consists of two more distinct operations, the grooving of the ring and the drilling of the holes; both operations should not cost to exceed 10 or 15 cents, which is a small item compared with the saving obtained by the increased service.

ENGINE HOUSE KINKS; MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.

BY B. N. LEWIS.

Roundhouse Foreman, Enderlin, N. D.

PLATFORM FOR BOILER WASHER.

A large amount of time and labor are ordinarily expended in arranging temporary platforms for washing over the crown sheets and tubes of locomotive boilers. This is especially true in bad water districts, where the boilers have to be washed after every trip. A light platform for this purpose, which may be easily adjusted, is shown in Fig. 1. It is 3 ft. wide and 5 ft. long, and is made of two strips of 3/8-in. x 1½-in. iron, to which a 7/8-in. x 5-in. matched pine floor is secured with bolts. Loops

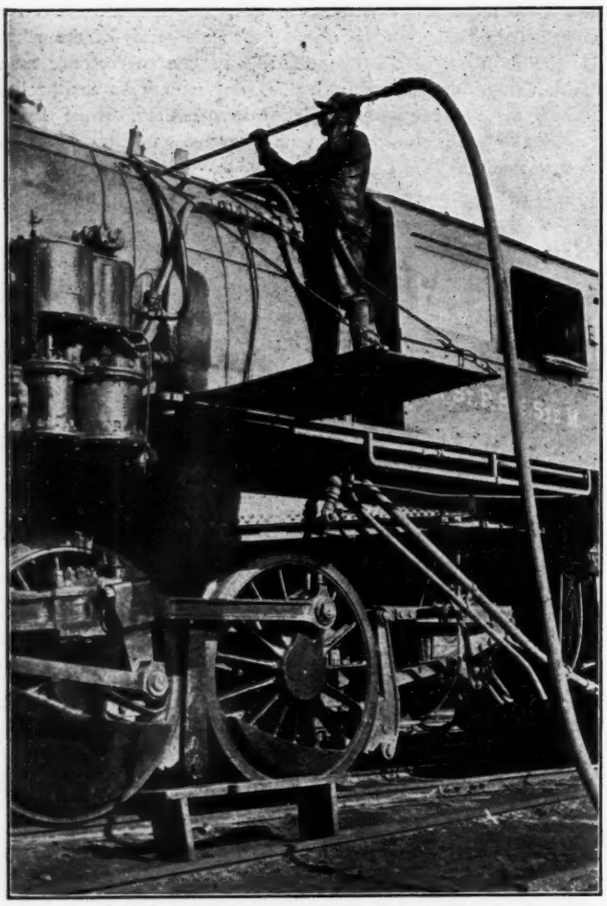


Fig. 1—Platform for Boiler Washer.

are formed at the outer ends of the iron strips, which may be connected to the hand rail by two 7/8-in. round iron rods made with a hook at each end, and the two pieces of chain each having four links, as shown in the illustration. The chain allows the platform to be properly adjusted for the different classes of locomotives. At the other end of the platform the iron strips are offset to catch the edge of the running board.

BENDING ROLLS FOR LIGHT WORK.

A simple bending rolls for light work in an engine house, such as forming the petticoat pipes or for use as a clamp when flanging a baffle plate, is shown in Fig. 2. Not being located near the main shops, where we could have access to the rolls in the boiler or tank shop, we find indispensable. The top roll is made of standard 4-in. wrought iron pipe, and the lower ones

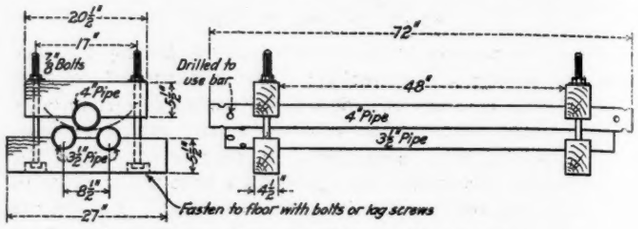


Fig. 2—Bending Rolls for Light Work.

of 3½-in. pipe. The rolls rest on 4½-in. x 5½-in. oak blocks, which are fastened to the floor by lag screws. They are revolved by using an ordinary bar in the holes at the end of the pipes.

OPPORTUNITY IN A RAILWAY SHOP.*

BY RICHARD KEEFE.

Apprentice, New York Central & Hudson River, Oswego, N. Y.

Casey-Jones has two sons; one a bright, well-set-up lad, whom it is decided will be a doctor, even before he has worn long trousers. The other son shows no bent for anything, unless it is three square meals a day, so he is rushed into long trousers and sent to the railway shop to earn the price of them.

The state aids Casey-Jones to make an M. D. of his bright son and then the public pays the bright fellow well to perform an autopsy or break up a fever—and hats off. State nor father pay attention to the other chap, who becomes part of an organism so great that its arms encircle the globe, its head in the aurora borealis, and its feet seeking the south pole; an organism so complicated that the defect of one part affects another separated by thousands of miles, and one that makes the dope-can as important as the general manager's pen. This organism is an army; it has its cavalry (the clerics), its artillery (the directors), and its infantry (the toilers), the branch in which there is no honor, but upon which the other two rest—the foundation.

This is the branch that takes in young Jones, and it requires him to respect himself and respect labor. Shirks are not wanted in the infantry; he will have to work for an opportunity—work hard without any prizes offered for even 100 per cent. work, and he must prove himself a 100 per cent. man to hope for promotion, unless he is thirty-second cousin to the boss.

In a smaller place Jones would get more knowledge of some one thing, but his work would lack variety, life, the touch with big things, which is the fascinating part of railroading. This is what rouses even the half-asleep boy and pushes him up, for like the pumpkin, growth is from within, as well as thought, and Jones thinks he has his problems. The greatest of these is as yet unsolved, the problem of capital and labor; but he dreams of a time when they will smoke the pipe of peace and bury their differences so deep that they will sleep the sleep that knows no waking, and both join hands in giving man a boost out of the slump. A pipe dream perhaps, but without it life would be too gray even for a fellow as healthy as Jones. The ordinary boy knows that in the railway service there have been ordinary boys who have climbed to high places. Such places are not all filled, and some of them make the position of an M. D. look sick by comparison.

The government of Cuba has authorized the Cienfuegos Palmira and Cruces Railway and Power Company to construct and operate a railway from Caonao to Manicaragua, and a branch line from the former point to Cruces.

*Entered in the competition on the instruction of apprentices and workmen, which closed April 15.

THE MISTAKES OF THE EFFICIENCY MEN.*

BY ONE WHO HAS WORKED WITH THEM.

V.

NEGLECT OF LARGE FACTORS.

A mistake common to the majority of the leading efficiency men, due perhaps to their zeal for a perfect control of the most minute details of every operation, is the neglect of certain large and important factors. The efficiency system cannot be separated from the other departments of shop activities, for the reason that it affects them all. It is not a branch grafted on to the main tree, but when properly introduced is a part of the body itself. There are many systems of shop management, which if installed in their entirety and strictly according to the ideas of their originators, are so complicated that it is manifestly impossible for a shop manager to familiarize himself with their details without neglecting many of the larger interests that have previously demanded his attention. Efficiency men, when given the opportunity to introduce scientific methods are often so intent upon proving the correctness of their theories that they, too, neglect the large factors. The difference is that they do so from choice, while the shop manager does so from necessity when he is required to adopt a system which he knows beforehand to be inadequate.

One of the most difficult problems confronting the efficiency engineer when he attempts to establish a new system of shop management is that of labor. The task of keeping the workmen contented without sacrificing profits is often the supreme test of a man responsible for their relations with the company. The successful manager is usually equal to this test. Efficiency men, however, are strangely blind to the attitude of labor toward a system which the men believe can tend only to reduce their earnings. Whether they are correct in this attitude or not does not alter the situation; they are a factor that cannot be ignored with impunity. An eminent efficiency engineer has said that "under efficiency operation strikes are inconceivable." It is because of this abounding faith in their theories that they fail to recognize the rumblings of discontent until the earthquake occurs. A disinterested investigator need not seek far to find examples of serious labor difficulties and strikes following the introduction on any extensive scale of certain efficiency methods; and many strikes are anticipated by withdrawing the specialist from the field. It is the policy of certain companies to avoid labor troubles at almost any cost—they do not like the notoriety and are anxious to get along amicably with their employees. In such cases it has often occurred that after the men have been strongly organized in opposition to the new system, their demands for increased wages have been granted as the price of peace.

In a certain manufacturing plant where there had been practically no organization among the workmen until the introduction of the standard time and bonus system by an eminent efficiency engineer, almost every craft quickly became strongly intrenched. During the operation of this method of shop management day rates were materially increased as an inducement to the men to accept the new basis of determining earnings. Afterwards, the attitude of labor—a factor which has been studiously ignored—became so hostile that the system was discontinued. The day rates, however, necessarily remain high, a permanent increase in cost, and where formerly organized labor was not an important element, it has now become a force to be reckoned with. In another important shop in the West a highly satisfactory piece-work system was displaced and standard time and bonus introduced. The same results followed, and upon the discontinuance of the new system a day rate equal to the former piecework earnings had been secured, with every advantage to the men, but none to the company.

Another factor all too frequently overlooked is the opportunities for increasing efficiency and reducing costs through simple expedients. Many a successful superintendent motive power has accomplished by the exercise of ingenuity and common sense what efficiency engineers, after exhaustive investigations and the introduction of theoretical schemes of doubtful value, have failed to bring about. Instead of following the line of least resistance they seem to prefer indirect and devious ways. Successful practical men know of better methods. If, for example, the cost of a certain class of locomotive repairs is running at, say, 12 cents a mile, the superintendent motive power may reach the conclusion that it is too high. It is not necessary that he should make an extended investigation in order to determine exactly how excessive his costs have been. Comparative figures interpreted by common sense and good judgment will tell him closely enough for his present purpose, and he may conclude that the cost should average not over 9 cents. He has thus arrived, through the expedient of a simple determination of the possibilities, at a standard which may be termed a *practicable* ideal cost as distinguished from a *theoretical* ideal cost. Then by another simple calculation of charges and credits, and through comparative records by divisions, roundhouses and shops, the percentage of inefficiency may be determined and localized. If traceable to defective organization this can be corrected; if due to some inherent weakness in the design of any particular part of the locomotive, the part can be strengthened. This, of course, is not the "scientific" method, for it does not attempt to determine *for every separate operation* included in the cost of repairs the actual cost and efficiency. It is enough for all practicable purposes at this stage to know that the costs are computed on the same basis as formerly and that the figures for different periods are properly comparable, so that if costs are reduced from 12 to 9 cents a mile he is assured that it is not in the bookkeeping but that a reduction of 25 per cent. has actually been made.

It is a fair statement that if in a certain instance locomotive or car repairs are excessive by, say, 30 per cent., it will cost less than half as much to save the first 20 per cent. as to save the last 10 per cent. In fact, it is not unlikely that it would be practically impossible to secure the last 10 per cent., however elaborate a system might be installed. When the cost of a system is equivalent to the possible savings, it is, of course, only a useless burden. Proof that a high efficiency can be reached without recourse to a highly specialized system is found in the fact that it is recognized even by the scientific engineers that on many of the representative railways and in scores of industrial shops, low costs of operation accompanied by a high standard of service have been maintained for years. The possible economies through somewhat unscientific but effective calculations, comparisons and allowances, are enormous. They are receiving too scant consideration even by many otherwise capable managers; they are ignored almost entirely by the efficiency men.

By the introduction of efficiency standards determined by direct rather than roundabout methods, the establishment of fair allowances, the compilation of statistics in a practicable form, the advancement of men who show ability in a particular line and by the recognition of their efforts to bring about a high state of efficiency through liberal salaries, a number of railways have made such progress in reducing costs as to surprise even those superintendents motive power who have instituted these methods. These are fundamental factors, which bring results, and it is unfortunate for the efficiency men that they fail to recognize their effectiveness.

RED TAPE.

The objections of practical men to a system of shop management involving a large amount of clerical labor and introducing elements that tend to complicate operations, have met the ef-

*The first article, which considered the extravagant statements and claims made by efficiency engineers, appeared in the January 6 issue. The second article, on the failure of many of their theories when put to the test of practical application, was published in the issue of February 3. The third, on the neglect of the human element, appeared in the March 3 issue, and the fourth, on the unscientific methods used and the impatience for results, in the issue of April 7.

ficiency men on every side. The answer has been made that the new science is so different from the old that it is not understood nor appreciated. But so long as this new school depends for success more upon its familiarity with the theories that have been presented in defense of its radical departure from the usual procedure than upon an intimate knowledge of the industry at hand, it is approaching its problems improperly equipped. Ignorance of the fundamentals of efficiency on the part of the rank and file is more easily dissipated than wilful neglect of equally important fundamentals on the part of the scientific engineers. Their theories must be made applicable to conditions as they are, not as they have imagined them to be or as they should be, otherwise they fail. The leaders among them have built up a system whose parts are perfectly fitted to each other. Certain principles have been laid down, the absence of any one of which materially weakens the whole structure. Likewise in applying these principles specific requirements must be observed or the results are inadequate. This has involved complicated methods, usually characterized as "red tape." While the introduction of red tape has not been the greatest mistake made by the efficiency men, it is the one most commonly recognized. Perhaps 90 per cent. of the petty difficulties with workmen which often lead to serious disturbances are traceable to this cause. An efficiency scheme may be theoretically perfect—but if it lacks flexibility, it cannot succeed.

The principles of scheduling and despatching and of a proper routing of work have been recognized in well regulated shops for years; they go hand in hand with the division of labor. They do not, however, require elaborate records, with specialists in every department to determine months beforehand how and when each step shall be taken. Efficiency engineers would take from the foremen in a shop all initiative with reference to operations. The difference between a shop of the usual type and one in which such a system has been introduced is that the one is controlled from the floor by competent men trained to their task, and the other is run (not controlled) from the office. For example, a foreman may not tell a machine operator what he shall do, whatever the contingency may be; the workman must receive his instructions, except as to discipline and quality of work, in the form of a written order from the despatcher, as it would, of course, be contrary to the theory of the system for the foreman to interfere with the regular sequence of operations. If he had this right in a contingency he might assume it at other times.

If no emergencies ever arose, if materials always arrived as scheduled, if machines never broke down and men never failed to perform their tasks in a given time, it is conceivable that a shop might be operated by the issuance of written orders for every step, and not a word be spoken. But shops do not run in this way. The necessity for the practised hand to determine what shall be done under given conditions continually arises. This cannot properly be delegated to a despatcher, for the reason that a complicated schedule cannot anticipate emergencies. It lacks the personal element. In a manufacturing plant where detailed scheduling and despatching of all operations had been introduced on a large scale it was not unusual for a long line of workmen to be found before the despatcher's office awaiting their turn as men await their turn before the box office of a theatre. Often the line would be stationary for minutes while the schedule was being consulted to ascertain what job should be given out. It was not the despatcher's fault. He did the best he could, but he was only a wheel in a large machine, and could not know what was going on out in the shop. In a certain machine shop the writer has seen men in line twelve minutes and more waiting for orders. When the regular schedule has been seriously interfered with, due to unforeseen occurrences, the system has been known to fail utterly. In such an emergency the foreman has been obliged to take operations into his own hands in order to avoid serious loss. The result is that *instead of preceding and determining the order of the work, the despatching system often follows it and becomes but an expensive and cumbersome means of recording output.*

The difference between a shop employing forty men under the control of a single boss, and one employing hundreds is not one of essence, but of size. When the force is increased sufficiently to warrant it, additional foremen are employed. It is as easy to secure satisfactory results from a shop of four hundred men as from one of forty, providing its organization keeps pace with its growth. If in a small shop a simple schedule of requirements, put into the hands of the foreman at the beginning of the day or week, has proved sufficient, similar schedules submitted to the various foremen of a large shop may be equally successful.

The possibilities of perfecting a schedule to cover every contingency, so that all operations are planned in detail and follow each other as regularly as the ticks of a clock, has been demonstrated with more or less success in a certain manufacturing plant. The cost of maintaining the necessary organization, however, has been so enormous, that when dividends are passed in order to meet the expense of the system, the stockholders naturally are not favorably impressed by the demonstration. This is a case illustrating the truth so clearly put by "Exyl" in the April 7 issue of the *Railway Age Gazette,* that "the moment we begin to run a shop for a system instead of a system for a shop we begin to lose money.

A well-known efficiency engineer has recently said, "No manager, no accountant, knows where he stands unless he has records of quantity and price with efficiencies of both, of *every unit of materials used,* whether a ton of rails or a pint of oil; records of time and wage rate *for every operation* and the efficiencies; and records of time and investment charges *per hour for every operation.*" (The italics are ours.) It is not surprising that practical men should complain of red tape in a system that deprives the superintendent and foremen of the power of initiative, that necessitates the predetermination of the sequence of the minutest operations, that is so complicated that even the initiated do not agree upon its essentials, that calls for printed instructions to such an extent that it is almost impossible to keep pace with their contents, and that requires in determining "where we are at," the adoption of the formula quoted above.

INCOMPETENT COUNSEL.

When the efficiency men are charged with the mistake of giving incompetent counsel when their advice is sought, they are taken to task for ignoring one of the principles upon which their structure of shop management is built; for among the principles enumerated by Mr. Emerson in the series of articles current in the *Engineering Magazine,* not the least prominence is given to "competent counsel." We have read these and other similar effusions written by the chief efficiency men with the hope that much of what has been termed misunderstanding of their methods and theories might be cleared away. The particular series referred to has been hailed as a great work, and should contain the last word on scientific management. One has a right, therefore, to expect competent counsel at the hands of one speaking with such authority.

It has been correctly stated in the *Railway Age Gazette* on various occasions, that the interest in efficiency methods and scientific management has been increasing rapidly. It is a question, however, whether this is not in spite of, rather than because of, their exposition by certain efficiency men who are recognized as the leaders of the new philosophical school. Railway and industrial managers have been asking for bread and they have been given a stone. In the April number of the *Engineering Magazine,* is published the eleventh of the series of articles on "The Twelve Principles of Efficiency," entitled "The Ninth Principle—Standardized Conditions." Recognizing the importance of having conditions standardized and the economic loss due to the absence of standards, one naturally looks for valuable suggestions regarding this feature of scientific management. If there are any such suggestions in the article in question, a second and a third reading have failed to disclose them. As a

philosophical dissertation, it may have a place, but as a contribution to the cause of scientific management it is sorely deficient. It opens with an interesting chapter from the life of the grub, followed by a comparison of the standards of the spider and the firefly with those of man, much to the detriment of the latter. Egypt and her pyramids have a place, then consideration is given to the evolution of the aeroplane. Efficiency principles are compared to the framework of a dome. The eight-hour train between New York and Chicago, and the three-day schedule for general repairs to a locomotive are prophesied, but no hint is given of the methods that will bring them into being. A large publishing house (which, if we read correctly between the lines, paid dearly for the introduction into its plant of a certain system of shop management) is put on the rack with other business men, who do not progress because of "imaginary specters that terrorize the soul." The article closes with an appeal for standardizing conditions in "our lives, our shops and our nation." To what extent competent counsel is given to those who are interested in standardizing conditions can be judged from the above summary.

This absence of competent counsel is not peculiar to the article in question; in a previous installment of the same series on the subject of the first principle—"Clearly Defined Ideals," five pages are given over to a discussion of the seven ancient and the seven modern wonders of the world, and the seven American wonders. Nor is it peculiar to this series of articles. Ask one of the leading efficiency engineers to make a trip over a railway system, or make a study of a certain manufacturing plant, and to report upon the existing conditions and the possibilities. The larger part of such a report is likely to be akin to the conversation of Polonius, which Hamlet characterized as, "Words, words, words."

It is not unusual for certain efficiency men to refer the failure of their plans to a lack of co-operation on the part of those in authority. Is it not rather that the counselor has failed to give sound advice, and that consequently results have not squared with the promises? His attitude is too often that of one who never needs, but always gives counsel. That prejudice sometimes exists is no doubt true, but this is perhaps no more marked than that of many of the efficiency men toward the organization common to nearly all railway and industrial shops. This attitude on the part of at least one of the leading efficiency men is explained in his own words, as given on page 488 of the *Engineering Magazine* for July, 1910.

"In American organization a successful man becomes president; he selects his staff, his cabinet and—he puts it up to them. Each in turn selects his staff of managers and—puts it up to them. The manager selects his superintendents, and passes the power and responsibilities on to them. The superintendent selects foremen, and delegates to them the power 'to make good.' The foremen select their workmen, and transmit to them the power to do the thing the president really wanted done. The man at the bottom, with the least spare time to plan, the least training, the least compensation, runs the whole affair. This is the type—so usual, so universal, that many will wonder that it is questioned. It is the baboon, the wolf-pack, type of organization and it is all wrong."

We submit that this is neither a fair nor a scientific analysis of the "American organization." It is not to be wondered at that the counsel that is given when expert advice is sought, is usually incompetent—the real situation is so little understood.

CONCLUSION.

An effort has been made in these studies to point out for the advantage both of the efficiency men and of those who are interested, or should be, in the principles of scientific, or common sense, management, some of the chief mistakes that have figured in connection with its exposition and introduction. No claim is made to literary excellence in these discussions. They have been written by one who is himself deeply interested in the vital issues, and who recognizes and applies in his own field many of the principles that have been recommended, who is also familiar with extended efforts on the part of efficiency men to introduce systems of greater or less excellence. That they have made mistakes, however, need not be seriously regretted, providing profit is secured from them. The important thing is not to make the same blunders repeatedly. Those mistakes, which have seemed to the writer to be the most common, are (1) Extravagant statements and claims, (2) The failure of many of their theories when put to a practical test, (3) The neglect of the human element, (4) The unscientific nature of many of their discussions and conclusions, (5) Impatience for results, (6) Neglect of large factors, (7) Red tape and (8) Incompetent counsel. Of these the most surely fatal to the success of any advanced system of shop control, are the neglect of the human element and impatience for results.

The nature of these observations has precluded the possibility of a recognition of the good that has been accomplished by the efficiency men, either directly or as a result of the publicity that has followed their utterances. The fact that we have charged them with many and serious errors has not blinded us to those features of their systems which have merit. It is not our province to refer to them here in detail; it would be unfair, however, and might lead to a misconception of the purpose of these studies to close them without a word of commendation for those among the efficiency men who have urged the principles of a common sense management in the face of almost insurmountable obstacles. It has been largely a campaign of education, and a call has gone out to operating men of all classes to seek a more intimate knowledge of the details of their business. The charge of gross inefficiency that has become a popular slogan, while much exaggerated, has led to systematic plans to reduce waste, and economies have already resulted, which had not been considered within the realm of possibility. From whatever point of view this science of management may be considered, and in all the heat of argument, it should be remembered that the law of the survival of the fittest holds in the economic as in the animal realm, and that because the principles of scientific management are vital to our industrial life, they have come to stay.

SAFETY APPLIANCES.

BY CHARLES L. ALDEN.

Foreman Car Repairs, New York Central & Hudson River, West Albany, N. Y.

This subject, no doubt, is now uppermost in the minds of all car department employees from the superintendent of rolling stock to the inspector and car repairer. Let us consider some statistics from the last annual report of the Interstate Commerce Commission. Its inspectors have found the following percentage of defective cars and locomotives among those inspected during the past five years:

	1910.	1909.	1908.	1907.	1906.
Freight cars defective, per cent.....	5.2	6.03	6.6	7.8	11.31
Passenger cars defective, per cent.....	6.55	8.37	4.8	4.8	1.16
Locomotives defective, per cent.....	4.4	5.4	5.7	7.7	8.14

This indicates, so far as freight equipment is concerned, a steady increased oversight in inspection, repairs and supervision. In passenger service 1910 is better than 1909, but neither show up so well as the years 1908, 1907 and 1906. We are unable to say why this should be so. The condition of safety appliances on locomotives has improved steadily.

Under the number of defects per 1,000 cars inspected, we find an average of 65.33 made up, as follows, for the year 1910:

Couplers and parts.....	4.39
Uncoupling mechanism	7.55
Air brakes	36,89
Handholds	12.89
Ladders	.6
Sill steps	1.85
Height of couplers.....	1.13

Nearly 88 per cent. of the defects are due to defective air brakes, handholds, and uncoupling mechanism. Here then is where we could and should spend our energy effectively. Let

us ascertain the causes assigned by the commission for the defects relating to these three items. Of defective air brakes, 80 per cent. are for brakes cut out, cylinder and triple not cleaned within 12 months, release rod missing, retaining pipe defective, and train pipe loose, in the order given. Nearly 50 per cent. are for air cut out. Of the defective handholes, 70 per cent. were missing. No comment is necessary here, except that such a condition is serious. This mind you is for the year 1910.

Of defective uncoupling mechanism, 60 per cent. of the defects are for uncoupling chain broken, uncoupling chain kinked, knuckle pin broken, lock block broken, and lock block inoperative. Uncoupling chains (which includes clevises) are responsible for 70 per cent. of this, and can be avoided by using a chainless pin lifter, of which there are several types on the market that are effective and meet all requirements.

From the foregoing it would seem that more attention should be given to the cleaning of air brakes, missing release rods, loose and defective retaining pipes, causes for air being cut out, missing and bent handholds and sill steps, pin lifters of a different type, broken knuckle pins, and broken and defective lock blocks.

On roads on which the commission inspected 10,000 cars and over, the percentage of defects ranged on 13 roads from 2.0 per cent. to 8.4 per cent., the Pennsylvania being credited with the former; the Chicago & North Western, with the latter. On my road the percentage was 2.6. The average for the 13 roads was 4.6 per cent. The Southern Pacific is second on the list, with 2.3 per cent. These statistics are for the year 1910. Do they not serve to direct our attention to some particularly weak points in our inspection and repair work?

The commission under date of October 13, 1910, issued in pamphlet form an order to secure uniformity of application and location of ladders, grab irons, brake shafts, etc. This is a drastic change from old conditions, and in the end will surely reduce casualties. To make these changes looks big to most shop men, but it really is not, once a start is made. To this end let one man have full charge of it, he to be alert, active and patient. Before stenciling cars "United States Safety Appliance Standards," everything must comply with the law in every particular. One will find various interpretations, perhaps, of one or more sections or clauses. A good idea is for the ones interested to get together and agree on one interpretation, and, if in doubt, to get advice from the commission.

Take for instance the 2-in. allowable variation in the location of side and end ladders. Some have said ladders must not be spaced over 19 in., and less than 17 in. apart. This is only partly true, 19 in. being the *maximum, no limit* being given on the minimum. A provision not in the original pamphlet is to the effect that "when construction of car will not permit the application of bottom tread of end ladder in line with bottom tread of side ladder, the bottom tread of end ladder shall coincide with second tread from the bottom of side ladder. In which case this second tread shall have a foot guard same as bottom tread." Another is to the effect that the "maximum distance from bottom ladder tread to sill step may be 21 in." Also that stiles of wood ladder sides will serve as foot guards *"when 2 in. or more from face of car."*

Special care should be taken to avoid equipping any car, unless it is being rebuilt, that is likely to be retired from service within the time limit prescribed by law. This is an error that many no doubt will fall into.

As a rule I find that on cars with buffers 6 in. or over, and new M. C. B. latest type standard couplers, one can readily come within the clearances on brake wheels, steps, running boards and 30-in. passage from sides. On other cars with less than 6 in. buffers, etc., take advantage of the provision relating to cars built prior to October 13, 1910, for passage clearance.

WHAT THE APPRENTICES THINK OF MODERN APPRENTICESHIP.

The apprentices of the New York Central Lines were recently given a slip with the following six questions on it and were asked to honestly and briefly answer them and to turn the slip in to the instructor at the end of the school period with the face downward and unsigned.

First.—Do you like the school work or would you rather stay in the shop all the time?

Second.—Do you expect at all times to get more pay and have a better job on account of your shop and school training? (Answer by "yes" or "no.")

Third.—Do you think that it pays the railway company to educate you; that is do you do enough more work and better work to pay for the time spent in the school and pay for having a shop instructor? (Answer by "yes" or "no.")

Fourth.—Do you expect to always stay in railway service, or do you expect to go into some other kind of business some day? (Answer by "yes" or "no.")

Fifth.—Do you think the school work is too hard or too easy?

Sixth.—How would you change the present methods of instruction in the shop and school. Would you cut out some of the courses now given and put in other kinds of work or study? State exactly what you would do, if anything.

Apparently the boys believe in the benefits to be derived from a thorough course of practical shop training, coupled with a certain amount of classroom work. This has been proved in a practical way by the greater number of applicants for positions as apprentices at all of the shops on the system, as compared to the conditions of a few years ago before the installation of the new method of instruction. The percentage of those who expect to leave railway service is not as great as might have been expected, and indicates that the young men realize

	Question No. 1.			No. 2.			No. 3.			No. 4.			No. 5.			No. 6.					
Shop.	No. Replies.	School.	No School.	Replies.	Yes.	No.	Replies.	Yes.	No.	Replies.	Yes.	No.	O. K.	Too Hard.	Too Easy.	O. K.	No Home Work.	No Class Prob. Work.	Change Shop Instruction.	Change School Instruction.	Remarks.
W. Albany, N. Y...	103	96	7	103	102	1	103	91	12	103	89	14	77	11	15	..	42	8	29	7	.....
Depew, N. Y.....	55	54	1	55	50	5	55	51	4	47	37	10	48	..	6	38	..	..	..	..	.....
St. Thomas, Ont...	23	21	2	27	24	3	27	27	..	23	18	5	21	4	2	10	5	..	..	5	More courses for boilermakers and electricians.
Jackson, Mich	40	40	..	42	42	..	42	42	..	38	33	5	40	..	2	41	..	..	..	1	Provide drill in spelling.
McKees Rocks, Pa.	28	28	..	28	27	1	28	27	1	28	26	2	26	..	2	25	..	..	..	3	Provide elementary chemistry.
Beech Grove, Ind..	66	60	6	66	65	1	66	62	4	66	45	21	39	9	18	66	..	..	..	..	.....
Elkhart, Ind.	53	52	1	55	54	1	55	53	2	51	36	15	44	..	7	31	..	..	15	6	Provide higher mathematics. No blackb'd work.
Collinwood, Ohio...	102	97	5	102	98	4	101	98	3	87	59	28	72	11	6	56	...	..	25	13	Electrical course wanted. Instructor in car shop.
Oswego, N. Y.....	28	28	..	28	27	1	28	27	1	28	26	2	25	2	1	23	..	..	..	5	More English and business training.
Totals	498	476	22	506	489	17	505	478	27	471	369	102	392	37	49	290	47	8	69	40	
Percentages	..	96	4	..	97	3	..	95	5	..	78	22	82	7.7	10.2	64	10.4	1.8	15.1	8.7	

that there are good prospects ahead for those who have the advantage of a thorough training in the various trades. It is rather interesting to note that the proportion of boys who expect to leave the service is much greater in the West than in the East.

Judging from the fact that 82 per cent. think the present school work is about right, while 10 per cent. think it is too easy and 7.7 per cent. believe that it is too hard, it must be pretty well planned. We would naturally expect about that proportion of exceptionally bright and exceptionally dull boys. The home work is probably not very taxing, or a larger percentage would have felt strongly enough about it to have added their protests to the 47 boys who did object to it. Possibly conditions are more severe at the shop from which most of the protests come. That there are not more criticisms of the classroom instruction is undoubtedly due to the determined effort which has been made to provide complete courses for each of the various trades.

NEW MILLING CUTTERS.

A new form of spiral milling cutter used by the Cincinnati Milling Machine Company is illustrated in Fig. 1. The spacing between the teeth is 1¼ in., and this allows ample room for the

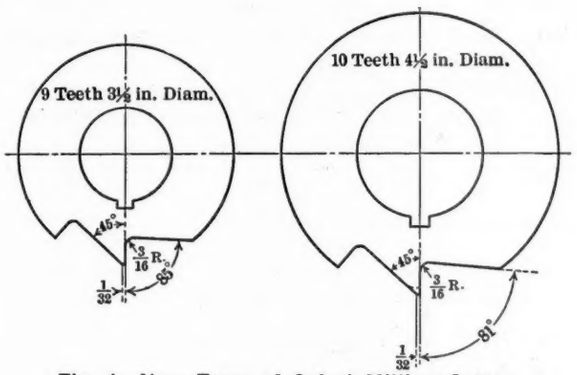


Fig. 1—New Form of Spiral Milling Cutter.

chips, the space being about four times as great as in the usual standard cutter. The advantage of this wide spacing of the teeth in spiral milling cutters is explained on another page of this issue.

The new standard end mills used by the same company are

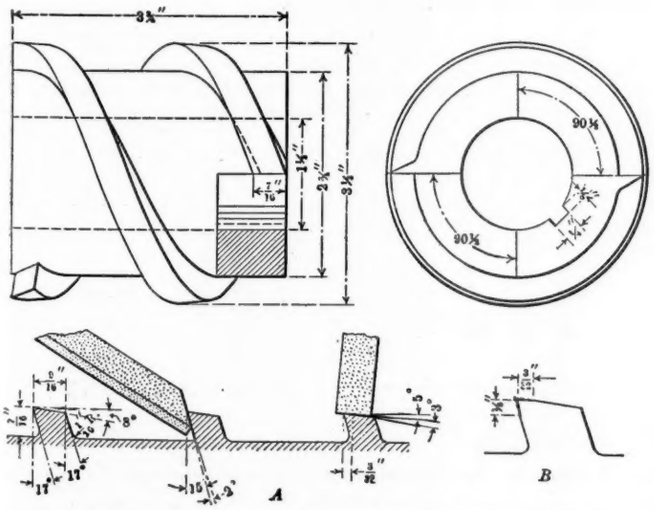


Fig. 4—Details of New Type of Helical Milling Cutter.

shown in Fig. 2. The one-inch mill has only four teeth, and the two-inch mill has eight teeth. In cutting these mills are remarkably free. A two-inch end mill will cut a slot 1 1/16 in. deep

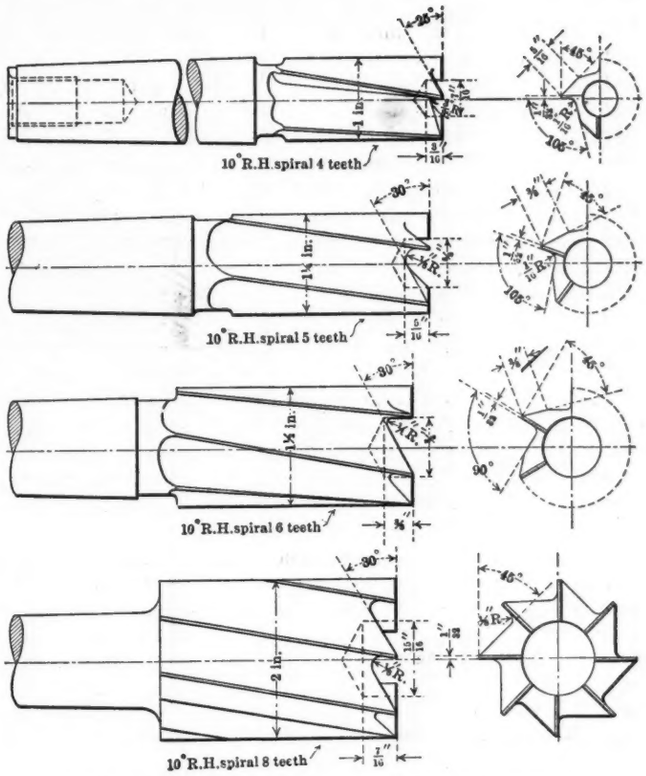
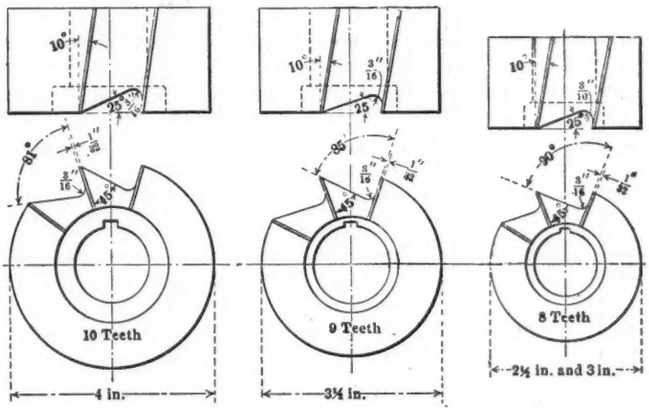


Fig. 2—New Type of Taper Shank End Mills.

in cast iron at the rate of 6 in. per minute. The same cutter removed a section from the end of a casting 1½ in. wide and 1½ in. deep with a feed of 11 in. per minute. A similar cut



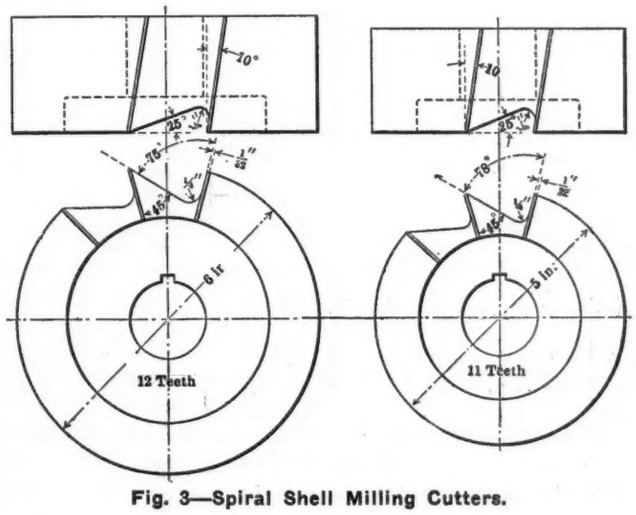


Fig. 3—Spiral Shell Milling Cutters.

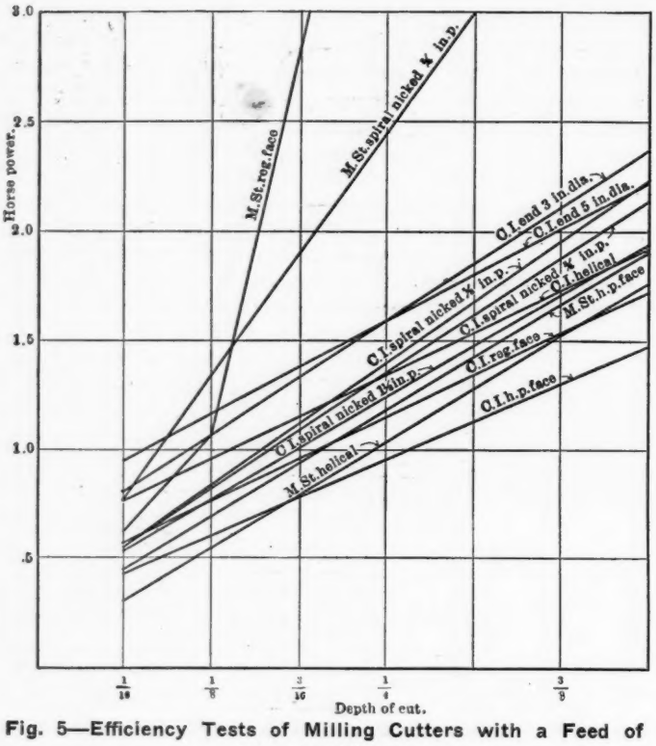


Fig. 5—Efficiency Tests of Milling Cutters with a Feed of 4 In. Per Minute.

Comparison curves reduced to 1 in. width of cut. Cast iron curves corrected for hardness of material.

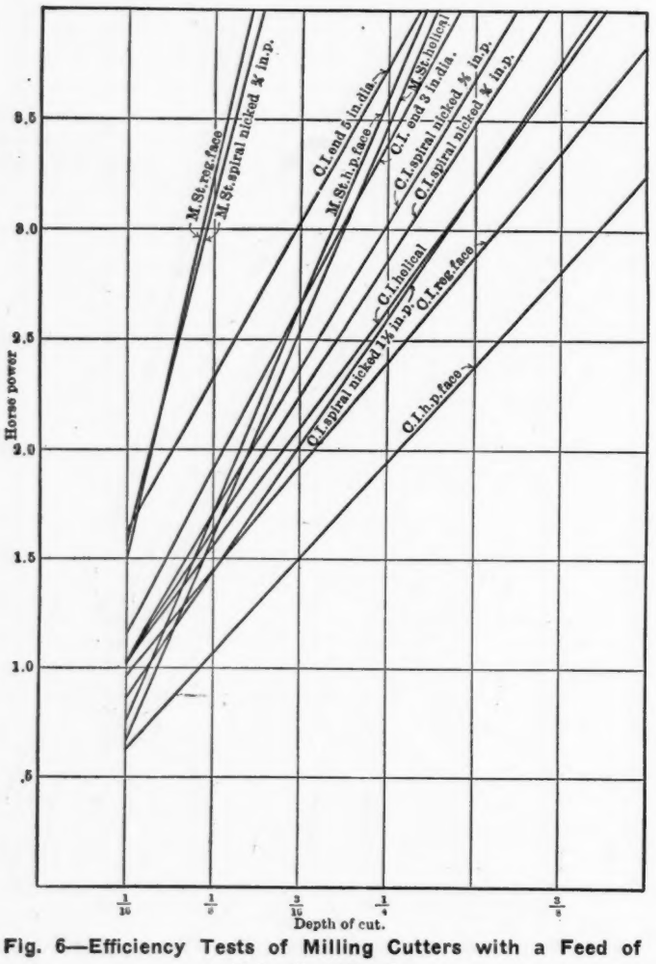


Fig. 6—Efficiency Tests of Milling Cutters with a Feed of 14 In. Per Minute.

Comparison curves reduced to 1 in. width of cut. Cast iron curves corrected for hardness of material.

1 in. by 1⅛ in. in section was taken with a feed 33 in. per minute. Shell end mills of the wide spaced type are shown in Fig. 3.

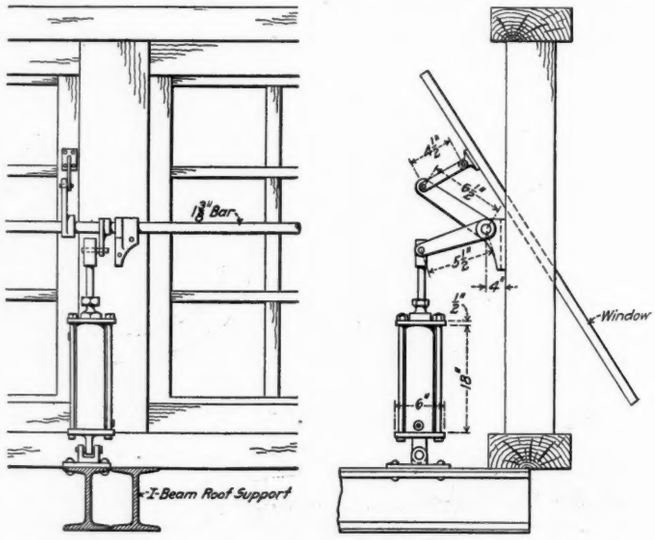
Perhaps the most interesting improvement is that shown in Fig. 4, illustrating the new type of helical cutter as designed by the Cincinnati Milling Machine Company. These cutters are very efficient when working on steel, and the power consumption is extremely low compared with that of ordinary cutters, the tests showing that a roughing cut in steel requires only one-third the power of an old style spiral mill. The chips come from the work in the form of gimlets with the back burnished, and the surface shows no sign of tearing of the metal.

Diagrams comparing the performance of different styles of cutters for different materials and various depths of cut are shown in Figs. 5 and 6. Fig. 5 gives the power required with feeds 4 in. per minute, and Fig. 6 with feeds 14 in. per minute. In Fig. 5 the lines are practically straight and show that for cutting cast iron the high power face mill is the most efficient. Then comes the regular face mill, then the spiral mills with various spacings; the end mills come last in efficiency. These end mills were of the old type with relatively fine spacing. The order of efficiency of the different cutters is somewhat different for machine steel. The helical mill comes first, then the high power face mill, then the spiral mills, and finally the regular face mill. In Fig. 6, with a feed of 14 in. per minute, the order of efficiency is much the same as in Fig. 5, with some exceptions; the helical mill, for instance, becomes more and more efficient as the heavier cuts are taken. These illustrations are from a paper on the "Efficiency of Milling Cutters by A. L. DeLeeuw," in the *Journal of the American Society of Mechanical Engineers* for April, 1911.

APPARATUS FOR OPENING AND CLOSING SHOP WINDOWS.

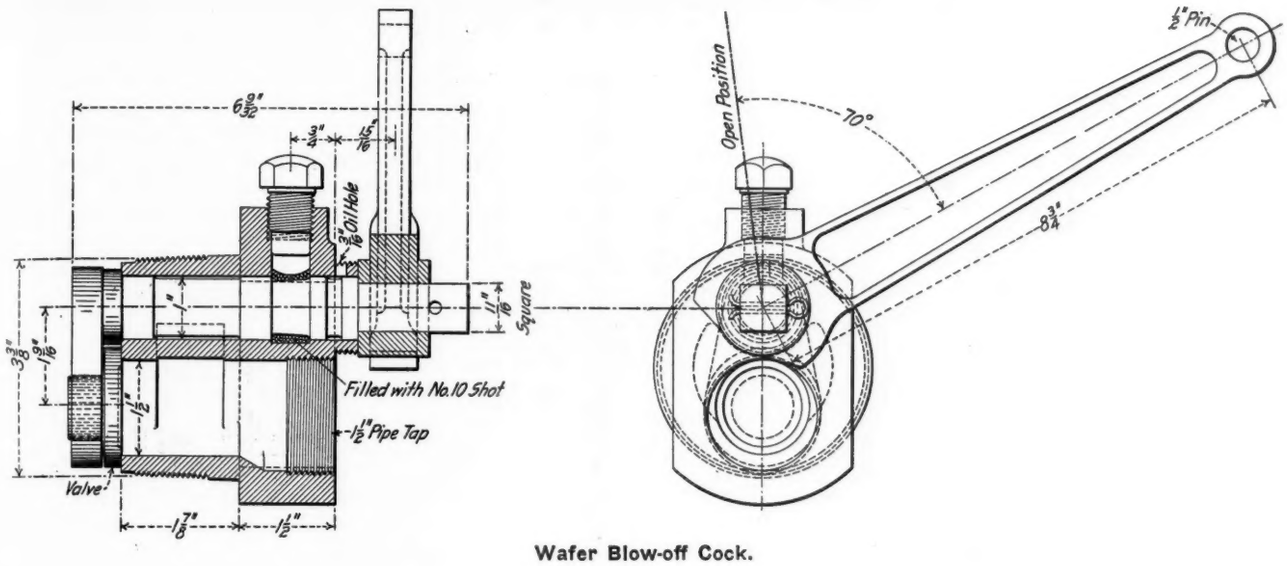
BY T. M. DRYDEN.

An arrangement for opening and closing shop windows by compressed air is shown in the accompanying illustration. It consists of an air cylinder 18 in. long, made of 3½-in. pipe, a long 1⅜-in. bar and the necessary connections. The cylinder sets on a pin which allows it to swing when turning the rod. The rod extends the length of the shop, being connected to



Apparatus for Opening and Closing Windows by Compressed Air.

the windows by the lever arms as shown. There are ⅜-in. air connections at the top and bottom of the cylinder to lower and raise the piston when desired. This arrangement is used in the shop power house of the Central Railroad of New Jersey at



Wafer Blow-off Cock.

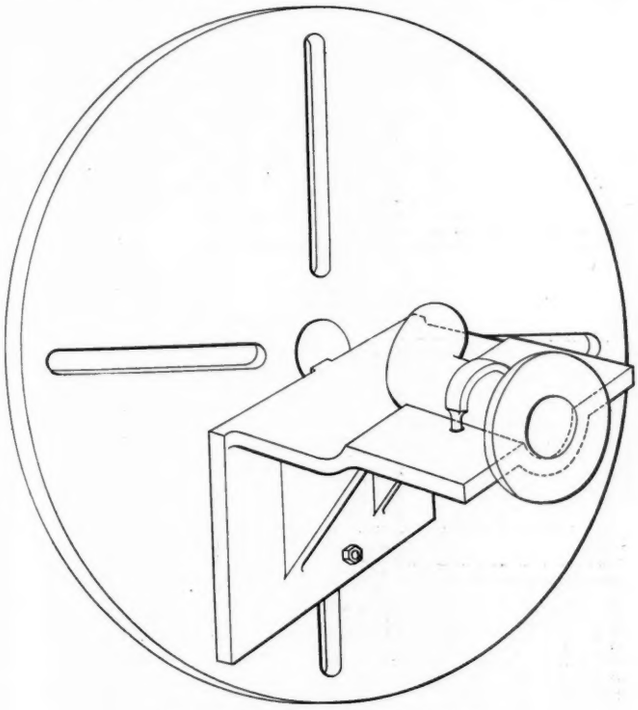
Ashley, Pa. It operates sixteen windows, and without a doubt could handle three or four times as many. It was designed by Frank P. Meekins, foreman of the car wheel shop.

MACHINING GOOSE-NECKS.

BY SAMUEL MAGILL.

Apprentice Instructor, Atchison, Topeka & Santa Fe, Topeka, Kan.

The bracket shown attached to the face plate of a lathe in the accompanying sketch, is a jig for facing, threading or drilling holes in a goose-neck. The tongue at the back of the jig fits in a slot in the face plate, and the semi-circular groove in



Jig for Machining Goose-Necks.

the jig, in which the goose-neck rests, is bored in line with the tongue, which makes the jig easy to adjust and set up. The goose-neck is strapped down into this groove. The output may be tripled with this device, which may readily be adjusted and handled by an apprentice, if necessary.

THE WAFER BLOW-OFF COCK.

The Chicago & North Western is using a new and improved blow-off cock, which was designed and patented by Wm. Wafer, foreman of the brass department at the West Chicago locomotive shops. The fixture has been in successful and satisfactory use for some time, and is greatly superior to the ordinary blow-off cock used on locomotive boilers. The principal feature is the separate disk with a lug which fits into the crank on the inside of the boiler with the pressure constantly tending to hold it tight. The crank is operated by a shaft which extends through a stuffing box filled with fine shot and having an outlet closed with a set screw. A malleable iron handle 8¾ in. long provides ample leverage, and has a sweep through 90 deg. for complete opening. The movement of the disk valve tends to scrape all scale and sediment from the seat and there is no difficulty in keeping it tight.

A MODERN LOCOMOTIVE REPAIR PLANT.*

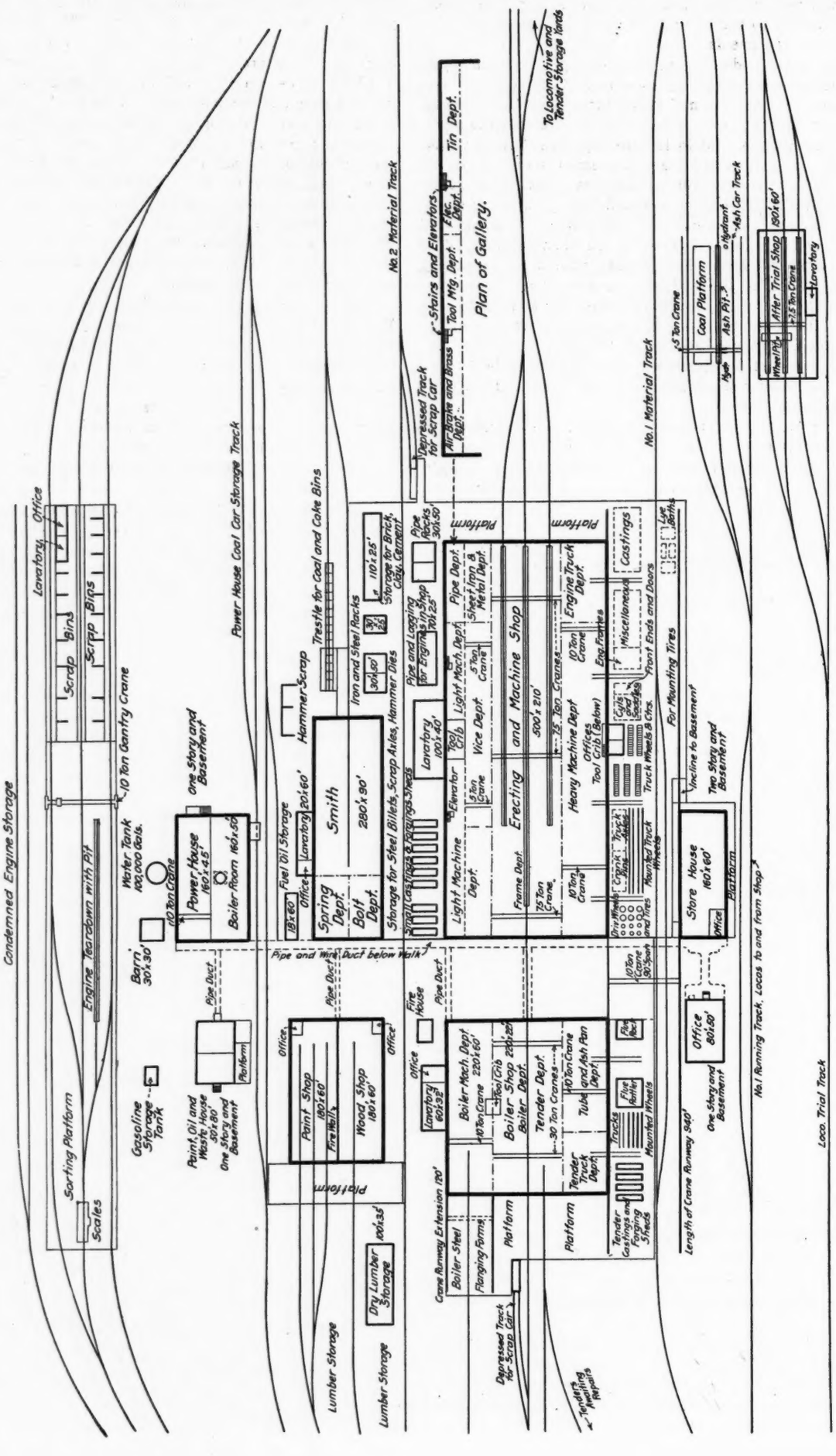
BY H. H. MAXFIELD.

Master Mechanic, Pennsylvania Railroad, Trenton Shops, N. J.

It is not the intention to discuss the relative merits of the transverse and longitudinal erecting shop. The writer has found that, as a rule, the opinion held depends to a great extent on whether past experience has been with a transverse or with a longitudinal shop. The longitudinal shop provides greater flexibility, more economical use of track space, and greater output from a given amount of track space.

The machine shop should house, besides the machine department proper, the vise, air brake and brass, sheet iron, tin and copper, and pipe departments. All of these are of necessity intimately connected with the erecting department, and not only should be adjacent to it, but under the same roof. The blacksmith shop is principally a feeder of the machine department and should be close to it. It should also be close to the power house, for it is a heavy consumer of steam, and practically the only consumer of steam in an electrically driven shop. As there is a great deal of boiler and tube work done in the erecting department, the boiler shop, if for no other reason than ease of supervision, should be close to the erecting shop. It should also be so located to avoid unnecessary time and labor being consumed in transferring boilers and tubes between it and the erecting department. The most convenient location for such a building would be as a continuation of the erecting shop, but should not be under the same roof on account of the incessant din. It is best located by placing it in a line with the erecting shop, but

*Abstract of a paper presented before the New York Railroad Club, January 20, 1911.



Suggested Arrangement for a Locomotive Repair Plant.

removed from it a reasonable distance. The middle track of the erecting shop should be continued through the boiler shop, in order to afford an easy method of handling boilers and tubes between these departments.

The wood-working department of a purely locomotive repair shop is one of diminishing importance, but it is still extensive enough to warrant a small mill under the same roof and jurisdiction as the carpenter or cab department. A considerable proportion of the work is done in the erecting shop. There is also considerable traffic between it and the smith shop. It should therefore be located as conveniently as possible to these departments, which can best be accomplished by placing it alongside of the boiler shop, opposite the smith shop. Practically all of the locomotive painting is done in the erecting shop, and a large proportion of the tender painting, other than varnishing, is done in the boiler shop. It does a good deal of work in connection with the wood department, especially as regards cabs, pilots and miscellaneous work. It should therefore be adjacent to the wood department, and reasonably near the boiler and erecting departments. This can best be accomplished by housing the paint and wood departments under one roof, and placing a fire wall between them.

The stores department should be located with reference to the largest consumers of material, which are the erecting, machine, vise, air brake and brass, sheet iron, and tin and copper departments. The casting sheds, boiler tube racks, iron and pipe racks, boiler steel yard, lumber yard, etc., all of which are under the jurisdiction of the storekeeper, should be located convenient to the points of consumption. The paint, oil and waste storehouse will naturally be located near the paint shop.

The location of the scrap bins will depend to a great extent on the size and shape of the property available. At its best it is an unsightly proposition, and for this reason the scrap bins should be located outside of the area bounded by the main buildings. They should be reasonably accessible and should be reached by trucks and cars from either end of the shop yard.

If a separate office building is provided, the main essential is that it should be reasonably accessible to all the shop departments, and as convenient as possible to the main entrance of the plant, so that visitors and applicants for work can, if desired, be kept out of the plant proper. It should also be located so that the private office commands a fair view of the plant in general. These conditions can perhaps best be met by placing it in line with the storehouse and about twenty-five feet in advance of the line formed by the ends of the boiler, wood and paint, and oil house buildings.

After repairs to a locomotive have been completed, it is necessary to fire it up and throughly try it out in order to develop minor defects. If an engine house is available, this work is generally taken care of at that place. In the case of the principal shop, however, it is possible that the nearest engine house is too remote to allow this being done, and, furthermore, it may be under different jurisdiction. Assuming the above to be the case, it becomes necessary to provide for this after-trial work at the shop proper. To bring the locomotive back into the erecting shop involves a serious delay to the work of that department, it being necessary to hold track space in reserve, which prevents bringing other locomotives into the shop, not only reducing the efficiency of the department, but reducing the earning capacity of the men. Furthermore, the escaping smoke and gases are objectionable. The only satisfactory way to handle this after-trial work is to provide a separate building for the purpose, making it an auxiliary of the erecting shop, and under the supervision of that department. This auxiliary shop, or after-trial shop, should be reasonably close to the erecting shop, and yet far enough away to prevent the escaping smoke and gases from flooding the other buildings. It should be adjacent to the track on which engines are tried, and also adjacent to the track over which incoming engines pass. Along side of the building should be a coal platform and an ash pit.

It will be noted that there is a rectangular space between the ends of the storehouse and the erecting and machine shop, smith shop and power house on one side, and the boiler shop, wood and paint shop and oil house on the other. The width of this space or street, is a matter of choice, but it should not be less than 80 ft., and it is preferable, as a matter of appearance, to have it 100 ft. The space formed by the side of the erecting and machine shop and the boiler shop on the one hand, and the storehouse and office building on the other, should be served by a traveling crane for the purpose of handling material. This space should be not less than 90 ft. wide to allow for the necessary tracks, platforms, etc. Between the erecting and machine shop and smith shop buildings should be a space of 80 ft. to allow of tracks, storage of material, etc. The same distance should be allowed between the boiler shop and wood and paint shop. At least 70 ft. will be required between the wood and paint shop and the oil house.

The width of the various buildings should be about as follows: Erecting shop, 90 ft. center to center of columns. This allows of three tracks spaced 30 ft. center to center, on all of which locomotives can be repaired, and, in addition, locomotives can be carried between these tracks without danger of interference. Machine shop bays, 60 ft. center to center of columns, which allows ample aisle room and a sufficient crane runway space between the machines. The boiler and tank shop building being, in a sense, a continuation of the erecting and machine shop building, should be of the same cross section. Smith shop, 90 ft. center to center of columns. The paint and wood shop building should be 180 ft. deep, which will allow ample space for six tenders on each track. The after-trial shop will require a maximum space of 75 ft. in width, while the coal platform and ash pit, etc., will require practically the same. Storehouse, 60 ft. center to center of columns. This will allow adequate bin and aisle space. The scrap bins will require a space 90 ft. in width, making due allowance for the necessary tracks, platforms, etc.

The machine department should be subdivided into, at least, two parts, thus separating the heavy machinery which should have full overhead crane service, and the light machinery which requires only partial crane service, and which may be advantageously laid out, partially, at least, in groups of machines driven from countershafts, they, in turn, being driven by suitable motors. The question arises as to whether the erecting bay should be in the center, and the machine bays on either side, or whether the erecting bay should be on one side and the two machine bays follow in order. In the latter case there is the advantage of having the entire machine department under, as it were, one roof, thus making the supervision somewhat simpler. Personally I question if this advantage means very much from a practical standpoint. The advantages of the other scheme are as follows: Symmetrical design of building; division of movement of material removed from locomotives, thus avoiding congestion in passageways; more advantageous storage of rough material outside of buildings in order that heavy material will not have to pass through the light machine department, and vice versa. There is no doubt but what the weight of evidence is in favor of the erecting bay being in the middle with the machine bays on either side. Experience with such an arrangement confirms this.

The light machine shop department requires only partial crane service. This allows of a gallery being put in this bay, running the full length of the building, the width of the gallery being something less than one-half the width of the bay. This allows the grouping of the lighter machines under the gallery. It also provides floor space in the gallery for the air brake and brass department, the tool manufacturing department, the tin manufacturing department, and the department for repairs to electrical equipment. That portion of the bay not covered by the gallery should be served by a traveling crane. On the ground floor of this bay, in addition to machinery, will be located the vise, pipe, and sheet iron and copper departments. In the heavy machine bay will be found sufficient floor space for the repairs of engine trucks, thus relieving the erecting bay to this extent.

The center bay of the boiler shop will be devoted to the repairs of boilers, tender frames and cisterns. In one of the side bays will be located the strictly boiler working machinery, flanging fires, laying off tables, etc., while in the other bay will be located the tender truck, boiler tube and ash pan departments.

The after-trial shop should be rectangular in shape and should have three tracks running through it, each track long enough to accommodate two engines with their tenders. This building should be equipped with wheel pits and an overhead traveling crane.

In order to complete the layout we will make the following assumptions: *First:* Number of locomotives to be maintained, 750. *Second:* Average weight of locomotives, 80 tons. *Third:* Character of territory served, generally level. *Fourth:* Character of traffic, mixed—high speed passenger, local passenger, fast freight and slow freight.

Under these conditions approximately 120 per cent. of the locomotives will pass through the shop for repairs each year, these repairs varying from new firebox and general repairs to machinery, to repairs such as renewal of broken parts, repairs due to wreck, or heavy running repairs which are not usually attempted in the ordinary engine house. With an equipment of 750 locomotives the shops will have to turn out 900 per year, or an average of 75 per month. A shop of this character should be able to turn out on an average three locomotives per track space per month, assuming that the shops are working under the piece-work system or under some individual effort system. Therefore the erecting shop will require 25 engine pit spaces. In addition, sufficient space should be provided to allow of making the necessary repairs to frames, etc., while the boilers are in the boiler shop having the fire boxes renewed.

If we make the erecting shop building 500 ft. long, and utilize the center track for repairs with the exception of an engine space at either end, and make the side tracks 360 ft. long, utilizing all the space for repairs, with the exception of one engine space at the entrance end, we will have ample room to accommodate 25 locomotives under repairs at one time, and also provide a space of approximately 9,800 sq. ft. for repairs to frames. In addition to this should be provided at least 6,000 sq. ft. in the heavy machine shop bay for repairs to engine trucks. This gives us a total of 51,000 sq. ft. of floor area for the erecting work.

The floor area required by the other departments is approximately as follows:

Erecting and machine shop building:		
Erecting department	51,000	sq. ft.
Heavy machine department	24,000	"
Light machine department	14,900	"
Vise department	9,100	"
Sheet iron and copper department	3,500	"
Pipe department	2,500	"
Tool manufacturing department (in gallery)	3,000	"
Tin manufacturing department "	4,000	"
Air brake and brass department "	4,000	"
Electrical repair department "	1,500	"
Total	117,500	"
Boiler and tender shop building:		
Boiler department	9,900	sq. ft.
Boiler machinery department	13,200	"
Tube and ash pan department	8,400	"
Tender department	9,900	"
Tender truck department	4,800	"
Total	46,200	"
Smith shop building:		
Smith department	18,000	sq. ft.
Spring department	3,600	"
Bolt department	3,600	"
Total	25,200	"
Paint and wood shop building:		
Paint department	10,800	sq. ft.
Wood department	10,800	"
Total	21,600	"
After-trial shop	12,600	sq. ft.
Power house	30,400	"
Storehouse	28,800	"
Paint and oil storehouse	8,000	"
Office building	8,000	"

SHOP KINKS; WHEELING & LAKE ERIE.

BY WILLIAM H. WOLFGANG.
Draftsman, Toledo, Ohio.

BLACKSMITH'S TOOL RACK.

A convenient tool rack used in the blacksmith shop is shown in Fig. 1. The top of it, on which tools may be laid, revolves

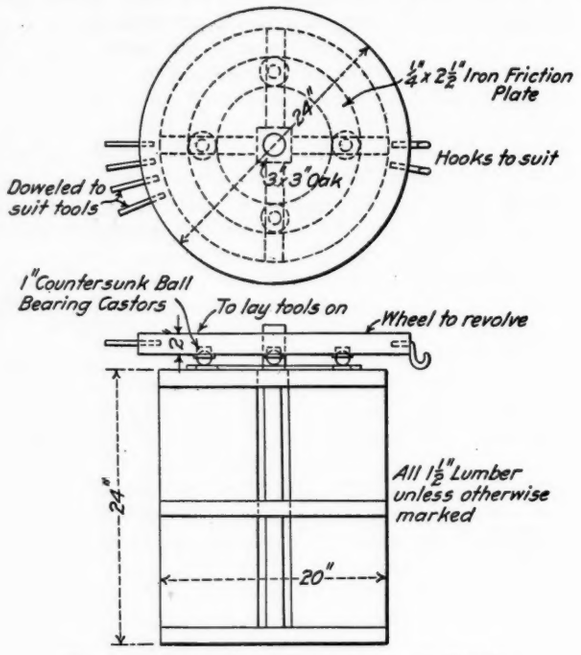


Fig. 1—Blacksmith's Tool Rack or Bench.

on four ball bearing casters. The tools may also be hung on the hooks or between the dowel pins on the circumference of the revolving table. The compartments underneath may be used for the storage of tools or material.

LUMBER TRUCK.

The truck for handling lumber, shown in Fig. 2, is not very heavy, and as it is mounted on ball bearing casters may easily be turned about or pushed over the floor in any direction. It is constructed largely of yellow pine, except for the oak strips which form the floor. These strips are placed 2 in. apart, so

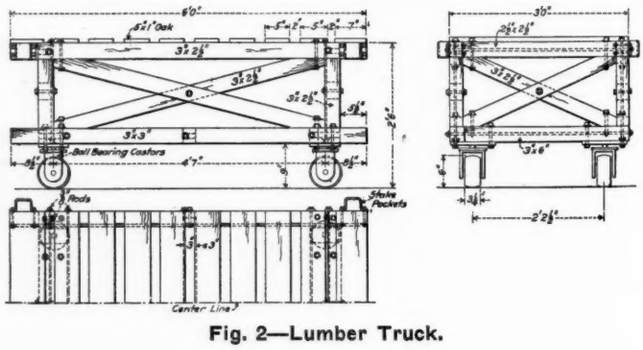


Fig. 2—Lumber Truck.

that a man can get his fingers underneath the timbers in lifting them off the truck. There are four stake pockets, so that stakes may be used if desired. The construction of the truck is clearly shown on the drawing. The casters were purchased from the W. A. Jones Foundry & Machine Company, Chicago, Ill.

TRUCK FOR HEAVY MATERIAL.

The advantage of the truck shown in Fig. 3 for handling heavy material, such as wheels, axles and couplers, is that it

is very low and the material may easily be loaded on it. The truck will run much easier if the journals are provided with 7/16-in. roller bearings. The floor is constructed of 2½-in. oak

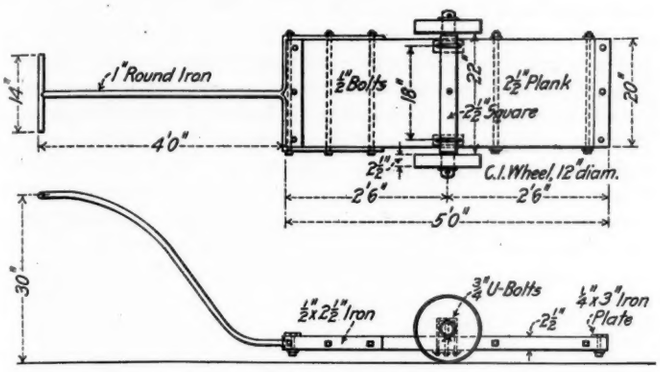


Fig. 3—Truck for Handling Heavy Material.

planks; the ¼-in. x 3-in. iron plates at the ends prevent the floor from being damaged in loading material on the truck.

FORGING COUPLER YOKES.

Dies for bending coupler yokes on a bulldozer are illustrated in Fig. 4. The stock, which has had the ends turned over, is placed between the dies, and as the crosshead moves forward the two wings are forced inward as they come in contact with the rollers on the short arms of the header. These rollers bear against steel friction plates. The 1-in. gibs on the bottom of the former fit in the bulldozer face plate slots and guide it. As the header of the machine moves backward, the two wings are drawn to their initial positions, as shown in Fig. 5. This

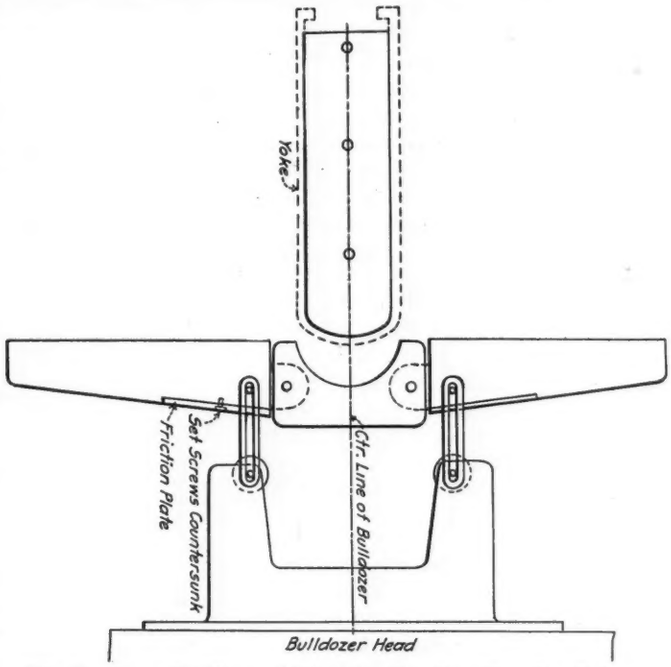


Fig. 5—Open Position of Dies for Bending Coupler Yokes.

arrangement makes it possible to bend yokes which are considerably longer than the stroke of the machine.

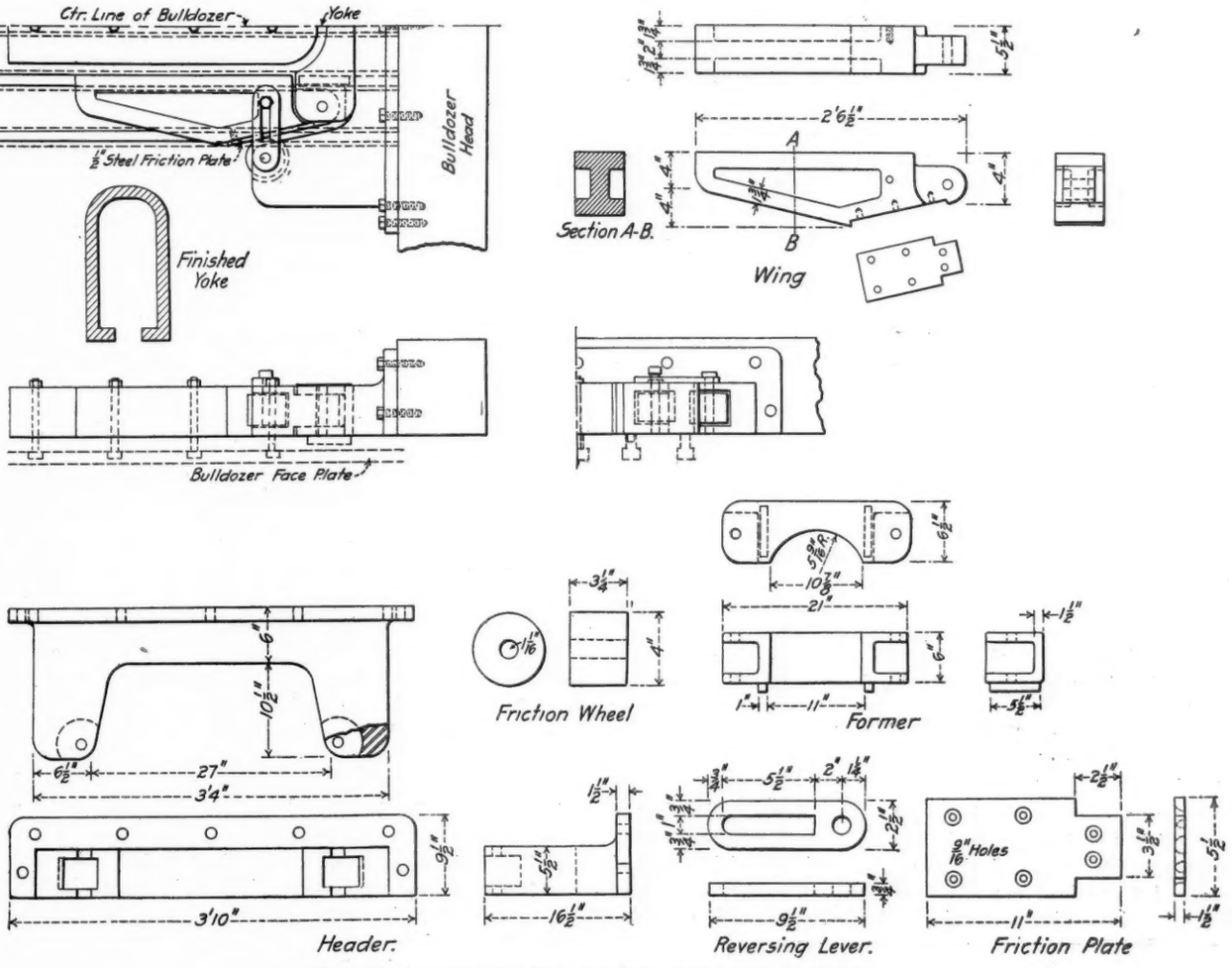


Fig. 4—Dies for Bending Coupler Yokes on Bulldozer.

THE RELATION OF EDUCATION TO INDUSTRIAL WASTE.*

BY HENRY GARDNER.

Assistant Superintendent of Apprentices, New York Central Lines.

Much is being said and written nowadays about scientific management and efficiency is the watchword of the hour. F. W. Taylor in his book, The Principles of Scientific Management, makes the following statement: "We can see our forests vanishing, our water power going to waste, our soil being carried by floods into the sea, and the end of our coal and our iron is in sight. But our larger wastes of human effort, which go on every day through such of our acts as are blundering, ill-directed or inefficient, are less visible, less tangible and are but vaguely appreciated. We can see and feel the waste of material things. Awkward, inefficient, or ill-directed movements of men, however, leave nothing visible or tangible behind them. Their appreciation calls for an act of memory, an effort of the imagination. And for this reason, even though our daily loss from this source is greater than from our waste of material things, the one has stirred us deeply, while the other has moved us but little."

But how shall we best eliminate these larger wastes of human effort which go on every day through our blundering, ill-directed, inefficient acts? Three ways present themselves; these are systematic education, suitable reward, and good-will or co-operation. Unquestionably education, or knowledge increases efficiency, since by definition efficiency means, "the state of possessing adequate skill or knowledge for the performance of a duty or calling." Skill originates in the brain and is a direct result of training, which is a form of education. The effect of suitable reward or wages is well known. Without good will no organization can be successful and no individual, however efficient, will exert an influence to prevent waste.

Since large industrial wastes of material and energy occur in our shops and factories, obviously we should bring education to these shops and apply it to those who are responsible for such conditions. This brings us to the practical question, how shall we best introduce this much needed education into our shops and factories; when and where shall we apply it and through what agencies shall we communicate it to those most needing it? Admittedly the best time to train or educate men is when they are young and in the adaptable and formative period; in other words when they are boys from 16 to 20 years of age. Prior to this time they will have obtained such common school education as is given to all. At 16 the boy is sufficiently matured physically to work in many factories, and at 17 he is usually able to work in shops assembling heavy parts, such as building and repairing locomotives and cars.

Modern apprenticeship—not the old time arrangement whereby the boy was wholly neglected and learned little or nothing—will effectually satisfy the need for that industrial education which is to aid us in the elimination of industrial waste of material and energy. The new apprenticeship system brings the school to the shop and there, in a suitable classroom, competent teachers instruct apprentice boys in the trades. This instruction not only covers the common school branches, but more than that, it embraces all the traditional knowledge which in the past has been possessed only by the older mechanics. This knowledge, intensely practical in character, is reduced to easy rules and formulas which are presented in a simple manner, abolishing all of that mystery which formerly surrounded such information. The school is not all. In the shop another qualified instructor shows the boy how to run his machine in the most efficient and economical manner, and by constant supervision prevents waste of time, energy and material. Wasted energy—lost motion—is more expensive in the human machine than with the ordinary machine. For example, with what infinite pains the designer calculates the time of the return stroke of the planer table so that one or two seconds may be saved at each reversal. But what overworked foreman can find the time to so instruct his men that seconds, or even minutes of their time shall not be wasted?

Incentive and efficiency are closely allied. It must be conceded that men will not willingly increase their efficiency without some incentive, either the never-failing incentive produced by increased reward or wages, or the incentive of increased ambition always found as a by-product of education. By ambition is meant the desire for success and wealth. Workmen cannot be expected to use their greatest effort and skill unless they feel that they are getting good returns for it. The best modern apprenticeship system, such as is now successfully in use on several of our largest railways, gives education free, without charge, thereby furnishing a well-recognized incentive for the increased initiative which produces higher wages, either through more rapid promotion or advancement (which will follow at the expiration of apprenticeship) or through the piecework system. This free education in itself constitutes a reward, inasmuch as it is given without bond or restriction; moreover it is something for which others pay.

Perhaps the most important feature of this whole educational system is the element of good-will which it introduces. The personal contact of the boy with his instructors creates a more friendly attitude towards his employers and his whole environment and working conditions. He is made to feel and understand that hearty co-operation which is the strength of the organization. Heretofore a considerable part of his time was spent in criticism, suspicious watchfulness, and often in open warfare. Good-will, more than any other factor, encourages that habit of conscientious saving which eliminates waste.

We have attempted to prove that waste of material and human energy could be largely reduced by the introduction of an adequate educational scheme, since all savings in material and effort are effected primarily through the employees. Coal, for example, costs a railway millions of dollars a year; how much of this could be saved if every fireman were willing and anxious to get the most steam possible from each shovelful? Is there any better way to bring this about that by stimulating his interest in his work through proper education, and at the same time instilling into his mind a feeling of loyalty for the company he serves? This familiar illustration of the coal and the fireman is more impressive, but not more significant, than the case of the mechanic in the shop or factory.

Not a few have criticized the modern apprentice educational scheme as too stimulating, developing leaders and leaving the rank and file—the men behind the guns—dissatisfied with their positions as skilled workmen or journeymen in the trade. But this has not been the case. After four years' experience one railway found that it had developed three or four times as many skilled mechanics as it had foremen or inspectors or draftsmen. Since these high grade mechanics receive upon graduation from their apprenticeship a day rate equal to regular journeymen in the trade, they cannot consistently be dissatisfied. Any apprenticeship system which neglects to recognize the superior ability of a young man who has successfully completed four years of intensely practical special training, both in shop and school, is bound to fail. It is impossible to keep a graduate apprentice from knowing his value to his employers, and he justly rates himself as the equal of any journeyman in his trade. He argues that his services for the four years have been well worth the wages he has received; if not he would have been discharged. His account so far is squared, and he is not willing to make a start all over again and work three or four years longer before arriving at journeyman's wages. Such a lack of appreciation can have but one result—desertion—and the graduate has no difficulty in obtaining more remunerative employment in some other shop or factory.

From the foregoing it may appear that we have made shop

*Submitted in the competition on the instruction of workmen and apprentices, which closed April 15, 1911.

efficiency wholly a function of the men and not of the management. Unquestionably the shop management must keep exact records of all materials used, and must see that these materials are always ready, and that the proper tools for doing the work are always available. We do not claim that industrial education diffused through the medium of a rational apprenticeship system will wholly eliminate waste, either of energy or material, but we may say conclusively that it does develop initiative, increasing efficiency, and induces that good-will and cooperative spirit without which the most exalted type of scientific management must fail.

SHOP KINKS; NASHVILLE, CHATTANOOGA & ST. LOUIS.

BY WILLIAM G. REYER.
General Foreman, Nashville, Tenn.

CASTING BRASS LINERS ON CROSSHEAD GIBS.

Instead of riveting brass liners on cast iron or steel crosshead gibs or driving boxes, we cast the brass directly on them. The clamp shown in Fig. 1 may be easily and quickly adjusted for any thickness of liner that may be desired. It has not been found necessary to heat the gib before pouring the metal. This does away with all drilling and riveting, and effects a considerable saving both in time and material.

PETTICOAT PIPE ADJUSTER.

A device that is convenient for properly setting the petticoat pipe and holding it in position while the hangers are being fastened is shown in Fig. 2. It may be adjusted to any size of petticoat pipe. The toggle joints which fit on the long bar are forced outward and fastened by the set screws, thus holding the petticoat pipe securely in place and central with the bar. The lower end of the bar is fitted with a plug which fits in the exhaust nozzle; the upper end may be adjusted to a central position in the smoke stack by calipering. The pipe may then easily be held in position while the hangers are being fastened. This is much more convenient than the old way of using a string and a plum bob.

GREASE CUP PLUGS.

With the device shown in Fig. 3, 60 grease cup plugs may be finished in one hour. A hole has been drilled through the drill press table allowing the plugs to drop through it into a box as they pass through the device. It is only necessary to clamp the chuck to the drill press table and to apply a square socket to the drill press spindle. The design of the plug is of interest. The projection at its bottom is forced into the hard grease and prevents the plug from loosening and working

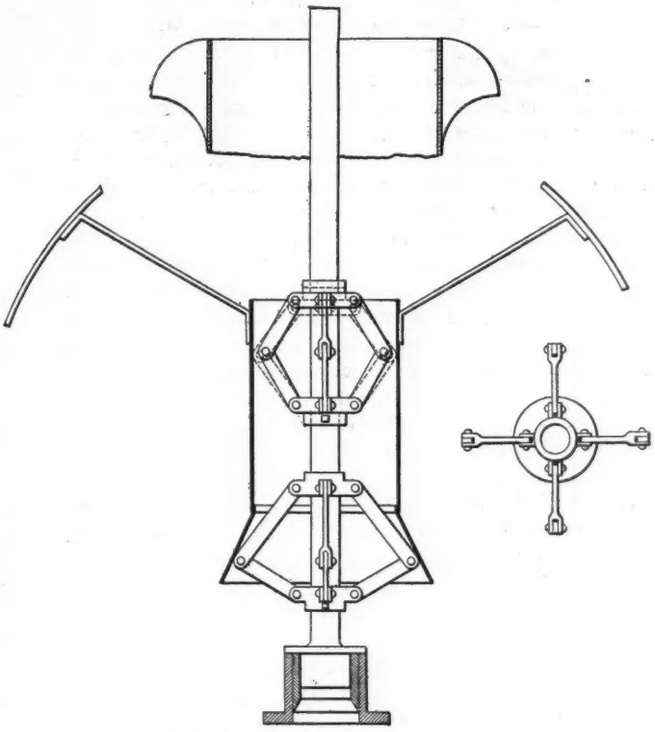


Fig. 2—Petticoat Pipe Adjuster.

out. The finished plug, which is made of brass, weighs 7 oz.; it would probably give just as satisfactory results if made of malleable iron. Another advantage of this style of plug is that the engineers do not have to loosen up a jam nut in adjusting it. The engines are supplied with a wrench similar to the one

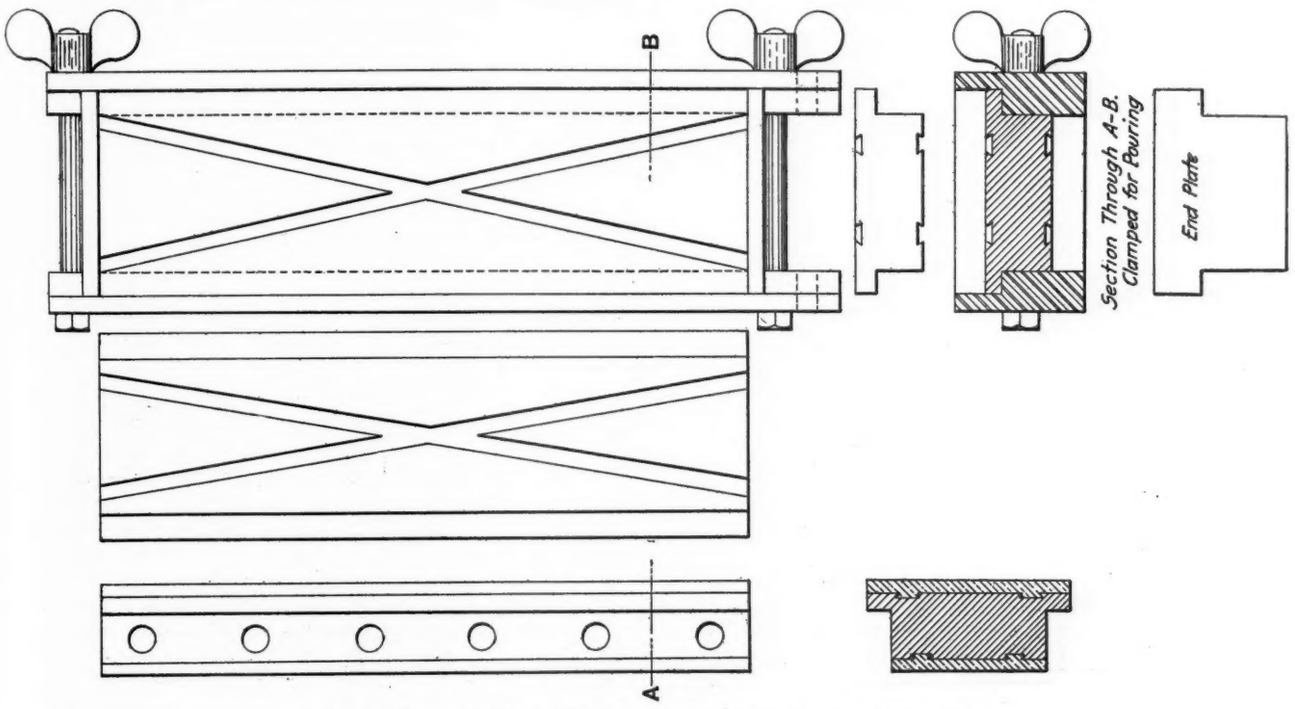


Fig. 1—Clamp Used for Casting Brass Liner on Crosshead Gib.

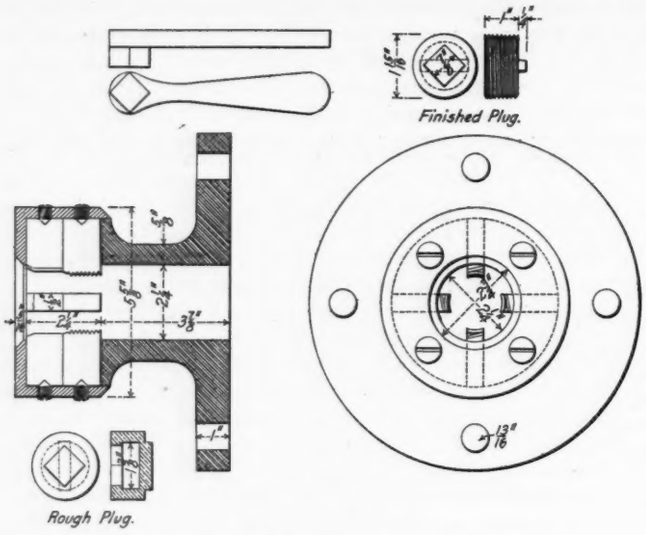


Fig. 3—Device for Finishing Grease Cup Plugs.

shown in the illustration, and the engineer has no difficulty in quickly tightening down the plug. The plugs should be screwed down into the cup their full length and should not be allowed to project above the top of the cup.

SHOP KINKS; PENNSYLVANIA RAILROAD.

BY C. C. LEECH.
Foreman, Buffalo, N. Y.

PRESS FOR LIGHT WORK.

The 30-ton press for rod bushings and link work, which is shown in Fig. 1, consists of a frame work of wrought iron, resting on an oak plank, and a standard hydraulic 30-ton jack. The jack is mounted in the framework as shown, the top fitting in the top crosspiece. The yoke or crosspiece on which the jack rests is supported by the springs at either side. As the jack is operated it is forced downward and the springs are compressed. When the pressure is released the springs return the jack to its normal position, as shown on the drawing. The frame work is simple and inexpensive, and may be constructed to suit any special requirements. The capacity of the press

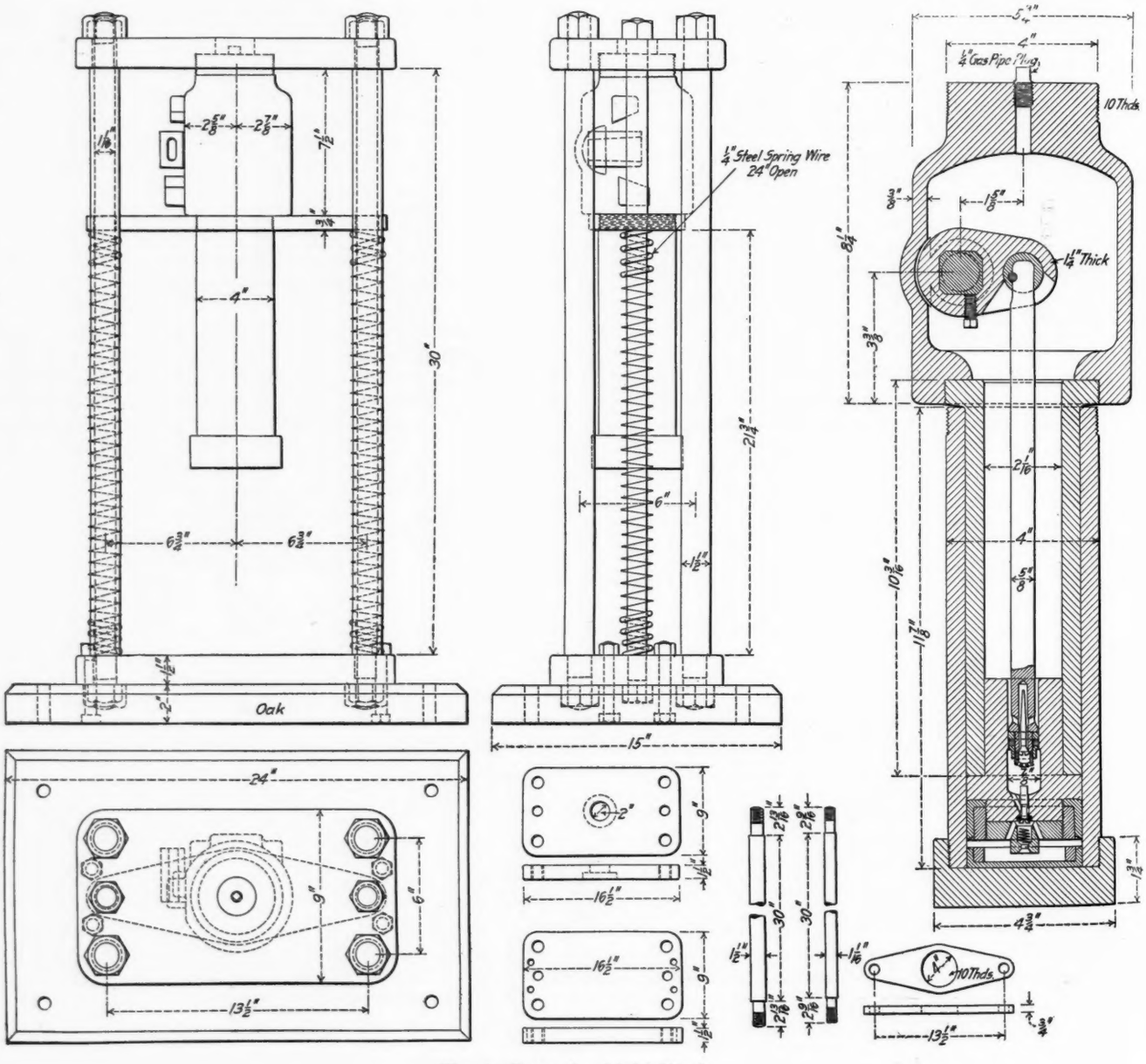


Fig. 1—Press for Light Work.

may of course be made greater by selecting a jack of a capacity suitable to the class of work which is to be done. If it is desired to make the press portable, it may be mounted on a small

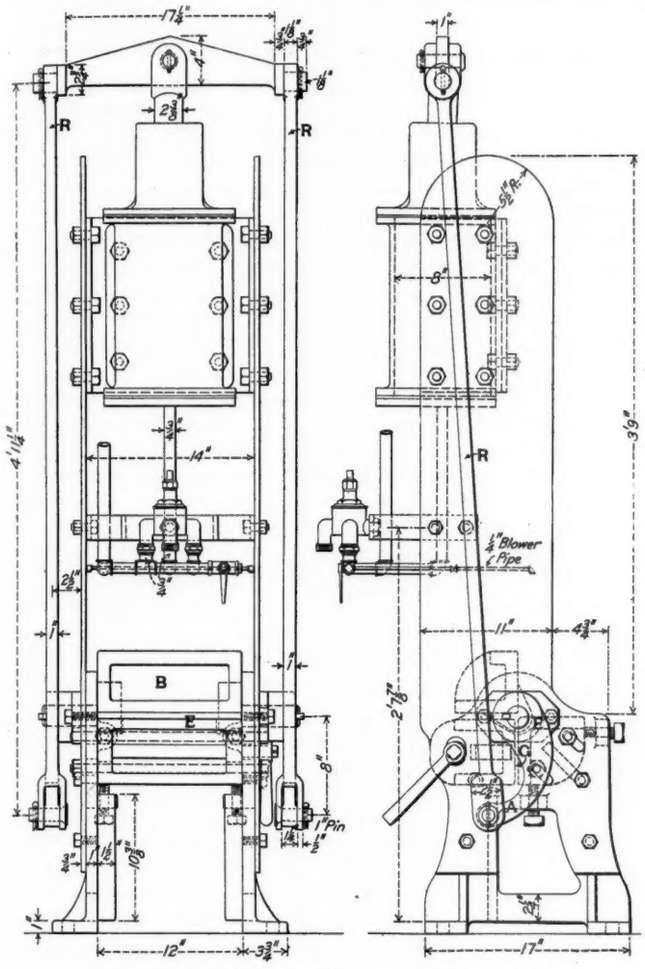


Fig. 2—Machine for Bending Right Angles.

four-wheel truck. It may be used to equal advantage in either the erecting shop or the engine house.

MACHINE FOR BENDING RIGHT ANGLES.

In using the machine for bending right angles, shown in Fig. 2, the material is heated at the point where it is desired to make the bend, and is then placed in the slot G in a vertical position and clamped. The 8-in. by 10-in. air cylinder actuates the arms A through the rods R at each side of the machine, which are 1 in. in diameter. The arms or levers A are keyed to the heavy casting B, which moves far enough to bend the iron, which projects above the slot G, down to the table E, thus forming a right angle. The frame of the machine is constructed of steel plates, castings and forgings, as shown. Iron up to 5-in. x 1¼-in. in section may be bent in this machine.

SPRING BALANCE FOR LOCOMOTIVE BELL.

A bell yoke and spring balance as used on the locomotives of the Pennsylvania Railroad is shown on the accompanying drawing. The spring balance is intended to secure a more uniform movement of the bell and prevent it from turning over when the bell cord is pulled vigorously. The spring case is secured to the bell stand by two bolts, and the plunger with its cap is pin-connected to a yoke which has circular bearings on lugs cast on each side of the bell stand. A small lug projects below the trunnion arm, and before it revolves through 90 deg. it comes in contact with one or the other ends of the yoke, tending to lift it and to compress the spring. The spring thus acts as a stop with a yielding resistance causing the bell to return to its normal position and preventing the excessive movement which would overturn it.

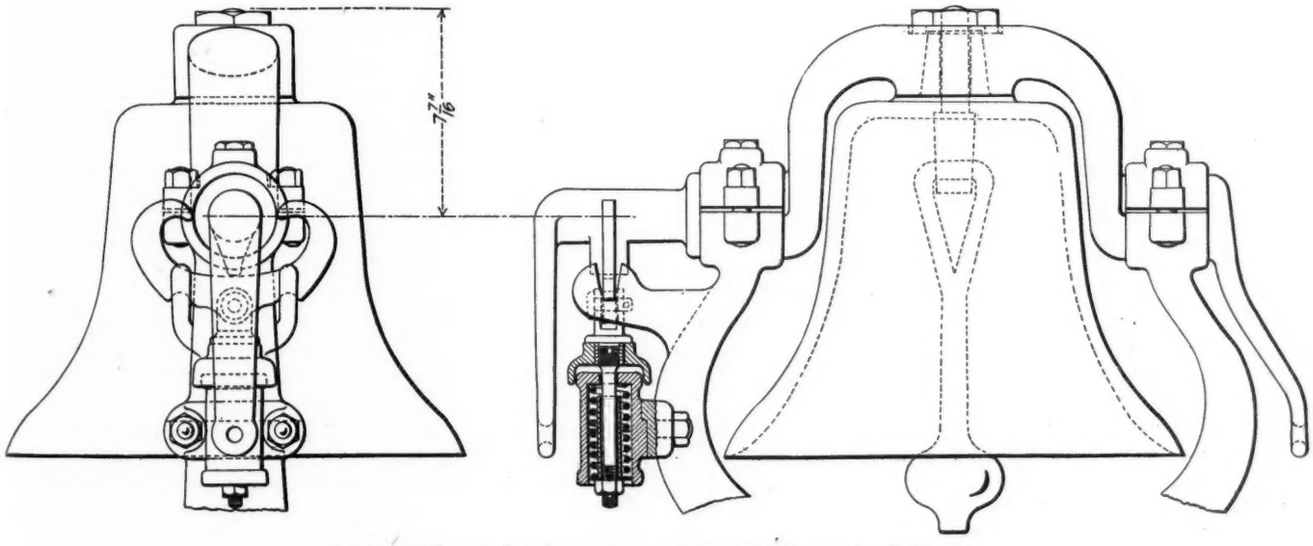
INSTRUCTION OF WORKMEN AND APPRENTICES.*

BY JOSEPH W. L. HALE.

Head Instructor, Pennsylvania Railroad School for Apprentices, Altoona, Pa.

In order that a proper efficiency may obtain in the industrial life of the nation, those engaged in manufacturing and industrial callings must effect a rational system of practical education, having as its aim a proper utilization of the conditions of modern trade and industry. During the middle of the nineteenth century the skilled mechanic, as such, was not given the proper attention. This was due largely to the rapid changes in industrial conditions brought about through the introduction of labor-saving machinery with the consequent high specialization of labor. Through these causes, and on account of the former neglect to provide a proper system of recruiting the service, the decrease in the number of skilled and intelligent employees has been felt very keenly in recent years. What is the solution of the problem of providing employees who can bring both skill

*Entered in the competition on the instruction of workmen and apprentices which closed April 15, 1911.



Spring Balance for Locomotive Bell; Pennsylvania Railroad.

and intelligence to meet the present complex conditions? During the present decade many of the larger and more influential of the manufacturing and railway companies will endeavor to solve the problem by providing their employees with a form of training furnished through the medium of shop instructors and a shop school located on shop ground with instruction provided during working hours. This movement, which has already taken a strong root in the interest of the young industrial worker, forms the essential element of the modern or new apprenticeship. Other modern methods for producing greater skill and intelligent workmen in industries, may be grouped under the heads of trade, industrial and correspondence schools. At present, through these means, a vast army of industrial workers is receiving instruction in specific trades and callings.

If one reviews the present situation, he is sure to find a strong appreciation, such as never before shown, of the returns which an investment in education will provide for the employer. As exemplified in the new apprenticeship, the attempts to meet the present situation by the larger concerns is through a means providing academic training closely co-ordinated with the shop work of the trade. Examples of this are shown in the recent high development effected by the New York Central Lines, the General Electric Company, the Pennsylvania Railroad and others. The writer recently had the privilege of inspecting one of the largest of recent developments—that of the New York Central Lines. The development of the system thus far effected, it is believed, is such as to place the work out of the experimental stage and establish it on a firm basis as an integral part of railway organization. Apprentices have already been graduated in some instances and the general development and efficiency produced has been very marked, such as to many times outweigh the investment involved in the training.

A prominent and necessary feature of the modern systems is the establishment on shop grounds of shop schools closely connected with the shop work. These the apprentices attend *during working hours while under full pay.* Night schools are inadequate to meet the present situation of the railways. The apprentice is decidedly "a day time proposition." This is entirely rational when viewed from a physical and physiological standpoint, to say nothing of the psychological principles involved.

The courses provide class room work covering, first, the fundamentals, that is, the three R's, and later a little higher development in mechanics and possibly some elementary physical principles, applied closely to the every-day shop work of the apprentice. Involving this elementary instruction are problem courses designed, first, to provide a general instruction for all apprentices, and later to bear more specifically on the separate trades. A course in drawing is taken with the class room work, beginning necessarily in an elementary way and applied throughout to the specific needs of the trade. This system is in vogue on a number of the larger railways at present, and is generally satisfactory. No small expense is incurred not only through the cost of instruction as such, but through the time which the apprentices give to the work. The time generally allowed is four hours per week.

There is a wonderful opportunity throughout the work for adapting the subjects of the common schools to specific industrial and trade needs. The question of how satisfactorily the present public educational agencies meet the needs of employers is altogether too extensive for this article. The fact that employers who are financially able are instituting their own systems in their shops, shows that at present the common public school, providing instruction for high school and for college and tending along cultural lines, does not meet their needs satisfactorily. This is, however, a question for the student of industrial education, who in attempting to solve the problem should review the remarkable work done at Cincinnati, Ohio; Fitchburg, Mass., and other places.

An important feature of a number of the modern systems of apprenticeship is the shop instructor, who amounts practically to an assistant foreman. His duties are specifically to instruct the apprentices in the shop work, to see that they secure the proper variety of work, and to prevent exploitation in any sense of the word. In a larger sense, he relieves the foremen of many responsibilities and his reports to the apprentice supervisor connects the work of the shop very vitally with that of the shop school.

The question may be asked, does the apprentice appreciate the efforts which so distinguish the present indenture or term of service from that under the old system? When every means is provided for a proper and thorough instruction and a keen interest is shown in his moral welfare there can be little doubt as to the manifestation of a strong appreciation. The writer can sincerely say from his experience with one of the largest companies, that this attention to apprentice welfare is decidedly appreciated, and will be more so when the apprentices have become journeymen. How many a foreman has said: "We did not have this opportunity when we were apprentices."

The new apprenticeship aims to develop not only industrial efficiency, but social usefulness. Through its efforts a marked influence for moral good can be exerted on the apprentice. He is made a better man and a better citizen, and is thus much better fitted through education and moral influence to meet the modern industrial conditions. It should be perfectly apparent that this is a decided contrast to the former practice, which did not look toward the moral side or that of broader training. A much better grade of employees is manifestly obtainable, and the shops furnish a far greater opportunity for the bright boy who would make a useful and efficient man.

What is to be done in the case of employers unable to provide a system of shop and school instruction on such an extensive plan? Many employers at the present time either encourage or require their apprentices to attend evening trade or industrial schools. The writer suggests that a far higher efficiency in more directly co-ordinating school with shop work might be effected by assigning a room within the works for apprentice instruction and allowing a portion of the time of one of the company's draftsmen or engineers to provide a course in drawing and problem work. If this instructor lacks pedagogical experience, evidently the method will lack somewhat in efficiency, nevertheless, it will open up a new field for later development and will surely many times outweigh in results any effort involved. The school room may not be elaborate; it may be a store room not in use, or a portion of a spare store room, which can be devoted to this work; only a portion of the time of the instructor may be required.

The effect of this direct interest in apprentices will, without question, be decidedly evident if the instructor has an interest in boys and a proper encouragement is given to his work.

Manufacturers and railways who do not appreciate the meaning of the new apprenticeship and the necessity for providing intelligent and skilled workmen, through attention to both their industrial efficiency and social usefulness, will be left behind in the struggle for industrial supremacy which is constantly growing stronger. In this case as in all others, the principle of the survival of the fittest applies with equal force. Efficiency may be obtained through the proper instruction and proper recruiting of the service.

FOREIGN RAILWAY NOTES.

The legislative council of Jamaica has voted to appropriate about $500,000 for the construction of a branch line in the Minho valley, which will open up a fertile district well adapted to growing bananas.

The opening of the railway from Nazan, Argentina, to Tinogasta has been authorized by the minister of public works. This official has also approved the plans and estimates of the first section of the state railway between Diamante and Curuzu-Cuatia, the estimates amounting to $1,242,146.

General News Section.

The Chicago, Burlington & Quincy station at Galesburg, Ill., was almost completely destroyed by fire on April 27; loss about $75,000.

Under the new Public Utility Law of New Jersey, free rides are so severely restricted that policemen and firemen can be carried on street cars only by paying fare.

Thirty-two railways in Texas show a deficit of $1,472,000 for eight months. Probably Texas will now legislate to prohibit deficits within the limits of the state.—*Wall Street Journal.*

The roundhouse and the repair shop of the New York, New Haven & Hartford, at Danbury, Conn., were destroyed by fire, April 25. Loss, including damage to three locomotives, $50,000.

A farewell luncheon was given to Warren J. Lynch, retiring passenger traffic manager of the New York Central Lines west of Buffalo, by fifty of his friends and railway associates at the La Salle Hotel, Chicago, on April 29.

Maintenance of way employees on the lines of the Canadian Pacific and the Canadian Northern between Port Arthur, Ont., and Vancouver, B. C., have received an increase of 14 per cent. in wages. About 10,000 men are affected.

Fourteen of the general officers of the Chicago & Alton and the Toledo, St. Louis & Western surprised George H. Ross, who recently resigned as vice-president of those roads, by presenting him with a loving cup on April 27.

The special commission on Boston transit problems, reporting to the legislature this week, recommends the construction of a subway through Boylston street from the Common westward to Charlesgate. The estimated cost of a subway over this route is $4,700,000.

The Pennsylvania Railroad Company, which now has offices at 2 Sherman street, Chicago, has leased 11,000 sq. ft. on the second floor of the Rand-McNally building, which it will occupy when the building at 2 Sherman street is torn down to be replaced by a new one.

The proposed amendment to the Oklahoma constitution eliminating a provision prohibiting foreign corporations to acquire control of railways in that state, was defeated at the special election on April 27. Preparations are being made to renew the fight for the amendment.

Suit has been filed by the government in the Federal Court at Prescott, Ariz., against the Atchison, Topeka & Sante Fe, for penalties amounting to $95,000, because of alleged violations of the 16-hour law as applied to train and engine crews. The complaint contains 190 counts.

To test their adequacy for carrying heavy loads of merchandise long distances, a number of automobile truck wagons were run recently from New York to Philadelphia and back in a single day. Four tons of merchandise were carried each way, but the number of vehicles or their size is not stated. The average rate of speed is said to have been 15¾ miles an hour.

The United States Steel Corporation has posted notices at the South Works of the Carnegie Steel Company, Sharon, Pa., to the effect that hereafter no employee may work more than six days a week. In the blast furnace, which does not close on Sundays, the rule will be that men who have to work on that day shall lie off one day during the following six days.

The first division of the Chicago & North Western to be awarded the banner provided by the management to be given each six months to the division which has made the best record for safety is the Sioux City division. The banner was conferred at a meeting of the officers and employees at Sioux City, Iowa, on April 20, the presentation speech being made by Ralph C. Richards, general claim agent, who is chairman of the Central Safety Committee.

On the Baltimore & Ohio, between Salem and Parkersburg, W. Va., the use of the Morse telegraph for train despatching has been resumed, in place of telephones. This is not because of any dissatisfaction with the telephone, but because of a consolidation of districts of the Monongah division. The telephone system has recently been put in use on an entire despatching district of the division named, and it will be extended to other sections of the road.

Francis Owens, who for 17 years has been connected with the auditing department of the Chicago, Milwaukee & St. Paul, has been appointed by the new mayor of Chicago as commissioner of track elevation for that city. The importance of this position is indicated by the fact that during the last 3½ years Mr. Raymer, Mr. Owens' predecessor, has had charge of the administration of ordinances covering the elevation of 250 miles of track and representing expenditures aggregating $18,000,000.

The Pennsylvania Railroad has finally declined to adopt the recommendation of certain employees, presented about two years ago, to make certain changes in the company's pension regulations. There was a movement to have the age of voluntary retirement changed from 65 to 60, and to provide for the additional burden which would thus be entailed, by having assessments made on the employees. The system will remain as it is; employees may retire at the age of 65, if incapacitated for service.

The General Managers' Association of Chicago, using figures furnished by the coroner's office, showing that 96 persons were killed during the past year while trespassing on railway property in that city, is urging the municipal court to enforce rigidly the city trespassing ordinance. The figures show that 77 were killed while walking on the tracks and 19 were stealing rides. The ordinance which it is desired to enforce was passed in 1907, and provides for a fine of from $5 to $100 for trespassing on railway tracks.

The Pennsylvania Railroad has recently issued a book of instructions printed in nine languages. This is for the benefit of men working on the tracks, with a view to enabling them to better protect their own lives. If such a book were to be adopted as a standard for the whole country, it would have to be printed in ten languages—at least. The Boca & Loyalton, a road in California, now controlled by the Western Pacific, has in its employ a number of Koreans. However, it is said, that the Koreans are to be discharged, as it has been found difficult to convey instructions to them.

Some of the western "insurgent" members of Congress propose a law to give the government a monopoly of building and operating railways in Alaska. The Secretary of the Interior has instructed the governor of Alaska to receive any complaints which may be made concerning railway rates in that territory; hear the evidence and report to Washington. It will be recalled that the Interstate Commerce Commission refused to assume jurisdiction over the railways in Alaska, and that in this position the commission was sustained by the United States Supreme Court.

The conflagration at Bangor, Me., on April 30, destroyed the Morse-Oliver building in which were the general offices of the Bangor & Aroostook Railroad. The Western Union and Postal telegraph offices and the telephone central office were also destroyed. None of these companies suffered any vital loss, but all were temporarily inconvenienced or crippled. The greater part of the business section, several hundred houses, the public library and high school, post office and custom house, several banks, six churches, etc., were destroyed. The total loss is estimated at from three to six millions.

Commercial clubs representing several cities in southern Idaho have joined with the Consolidated Fuel Company and the Castle Valley Coal Company of Salt Lake City, Utah, in a suit against a number of western roads for a reduction of rates on coal shipped from mines in Utah to points in Utah, Idaho, Montana, Washington, Oregon, Nevada and California. The complaint is made that under the present adjustment of rates the market in southern Idaho territory is monopolized by operators in certain coal fields lying along the Union Pacific, and that unreasonable prices are charged for the coal.

The governor of California has signed the bill limiting to 16 hours the working day of railway trainmen and telegraphers, passed by the recent legislature. This bill, now a law, appears to have been drawn with little care. It requires that when an employee has been on duty 16 hours he must lie off for 8 hours; but if he should work only 15 hours and 59 minutes, the clause prescribing a period of rest apparently does not apply. The penalty is $200 to $1,000 or imprisonment; but the accounts do not say whether this applies to the superintendent or to the employee, or to both. The time limit does not apply to men on wrecking or relief trains.

The Chicago, Milwaukee & Puget Sound is to use telephones for train despatching between Mobridge, S. D., and Deer Lodge, Mont., 755 miles. Seventy-five sets of selector and telephone equipments have been ordered from the Western Electric Company. The Pennsylvania Railroad, which is already operating a number of its divisions with Western Electric selectors and telephone equipment, has just ordered similar equipment for use on its Bellwood division. The equipment for this division consists of two complete circuits—one a train despatching circuit between Bellwood and Fordham, a distance of 65 miles, and the other a 57-mile message circuit between Bellwood and Punxsutawney.

A strike of maintenance of way employees in the Chicago terminals of the Chicago & Western Indiana, the Chicago Junction, the Baltimore & Ohio Chicago Terminal, the Indiana Harbor Belt, the Illinois Central and the Chicago, Milwaukee & St. Paul was called on May 1 at 6 p. m., by the International Brotherhood of Maintenance of Way Employees. This action followed a demand that the general managers of the roads concerned accept a uniform scale of wages and an agreement covering conditions of labor. The brotherhood claims to have a membership of 2,400 men on the roads concerned, and it is reported that a number of employees not members of the organization are also out on strike.

Governor Foss, of Massachusetts, in a special message to the legislature, advocates the abolition of the state railroad commission and the merging of its business with a public utilities board. The governor repeats the recommendations of a report which has been made to him by C. H. Scovell, criticising the methods or conduct of the railroad commission. Petitions of railways for the right to increase capital stock have been granted without thorough investigation of the business and earnings of the road. Reports of new equipment are not made by the roads to the commission with sufficient fullness, and the board does not make public record of its conferences with railway officers in regard to new issues of stock. The determination of the expenses of abolishing grade crossings ought to be a part of the duties of the commission instead of being made the work of a special commission in the case of each crossing. To abolish these special commissions would save the state $10,000 a year. The present law, under which the cost of running the railroad commission is charged against the railway companies is declared to be vicious.

A strike of shopmen in the shops of the Pennsylvania Railroad at Pittsburgh, Pitcairn and other points on the Pittsburgh division, which took place on Monday, May 1, brought work almost to a stop in those shops and resulted in some little violence, the newspapers of Tuesday reporting attacks on non-union men. The strikers say that 1,500 men have gone out. The company has dismissed large numbers of men during the past few weeks and the strikers say that in these dismissals the company has discharged some of its oldest men because they belonged to the union. The company at once began engaging new men and prepared lodging and eating rooms for them in or near the shops; and called for police protection. At Pitcairn it was said that the strikers induced the city or town to appoint men from their own number as guards over the railway company's property. An officer of the road said that the number of men who struck was 1,171 and that about 400 remained at work in the shops. The statement issued by the company said that on the lines of the company east of Pittsburgh and Erie about 20,000 men had been furloughed because of the depression in business. Committees of shop men went to Philadelphia last week and asked that all reductions in force be made on an absolute seniority rule, regardless of the qualifications of the employe. This request the general manager denied.

The Passing of the Green Flag.

On the New York division of the Pennsylvania, the through passenger trains which run to and from the new terminal in New York City, have to carry marker lamps on the rear car in the daytime as well as at night, because of the long tunnel which has to be passed through, and the keeping of these lamps on the cars so constantly suggested to the officers that flags were unnecessary. The suggestion was put in practice and now the lamps (unlighted) have been designated as regulation markers for trains running in the daytime. Experience has shown that the lamps are quite as distinguishable as the flags, and answer every purpose. The lamps are painted a bright green. The same rule has been prescribed on the Amboy division, over which some of the New York trains run. On the Belvidere division, the rule prescribing markers by day allows either green flags or marker lamps without lights.

Federal Examinations for Locomotive Boiler Inspectors.

The Civil Service Commission has recently issued circular 397, relative to examinations for district inspectors of locomotive boilers. The examinations will take place June 7-8, 1911. The salary is $1,800 per annum, and necessary expenses while absent from headquarters in discharge of official duties. The applicants must be between 25 and 50 years of age and also of good moral character and habits, active, intelligent, and discreet; of good speech and manner; qualified to address and confer with railway officials as occasion may require, and must have not less than three years' railway experience in the capacity of master mechanic, road foreman of engines, boiler maker, boiler inspector, roundhouse foreman, shop foreman or locomotive engineer; or not less than five years as locomotive fireman. The applicant must have been in active service in such capacity of inspector of locomotive equipment under the government of the United States or of any state or territory, within two years next preceding the date of his application. The experience required must be in addition to time served in apprenticeship or spent attending a technical school. Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for application and examination Form 1892. In applying for this examination the exact title, District Inspector of Locomotive Boilers, should be used in the application.

Passengers Burned to Death at Martin's Creek, N. J.

By the derailment of a southbound passenger train at Martin's Creek, N. J., on the Belvidere division of the Pennsylvania last Saturday afternoon, April 29, about 3 p. m., 11 persons were killed and 40 or more injured; eight of the killed being burned to death in the wreck, which took fire almost instantly after the cars lodged at the foot of a low bank, after being derailed. The train was an excursion from Utica, N. Y., bound for Washington, and the passengers were school teachers from Utica and vicinity, mostly women. The killed numbered seven passengers, the conductor of the train, the baggage man, the engineman and the tourist agent in charge of the excursion. Two other passengers are reported missing, and are believed to have perished in the fire. The train was made up of an engine and five cars and was running at about 40 to 50 miles an hour over a curve of 3 deg. The engine fell over on its side and the first two cars lodged nearly at right angles to the track.

The cars in this train, one combination, three coaches and one dining car all belonged to the Delaware, Lackawanna & Western, over which road they had come from Utica to Stroudsburg. The first two cars were equipped with Pintsch gas lighting apparatus; the third car, No. 100, with Commercial acetylene gas lighting apparatus; the fourth with Pintsch, and the fifth, the dining car, with acetylene. The fire started in the third car, No. 100, and it was in this car that nearly all the loss of life occurred. The gas tank beneath this car had been ruptured and gas issuing from the rupture appears to have been ignited as soon as the car came to rest or before. The train ran a considerable distance after leaving the rails and the ignition of the gas may have been due to coals spilled from the locomotive or from friction of broken parts. The fire spread rapidly to the rear and to the front. The gas apparatus on the fourth car was not seriously damaged; the gas pipes on the first and second cars were broken, but the tanks had not been punctured. There was no evidence that the gas had been burning when issuing from any of these breaks in the

pipes. It is believed that the gas in these two cars had escaped and had been dissipated in the atmosphere before the flames from the third car had reached the first or second.

The combustible parts of all of the cars were destroyed by the fire. Some hours after the wreck occurred the remaining parts of the dining car, one end of which had remained on the track, was thrown into the ditch; and by 8 p. m. the heat had so fused one end of the gas tank under this car that there was an explosion of the gas left in the tank, blowing off one end of it.

The passengers who were injured suffered mainly from being cut by glass in getting out of the wreck and from being burned.

The cause of the derailment has not been determined. Track repairers had been relining the surface of the track on the curve, but two passenger trains and a freight train had passed over the track after the men had stopped work and before the arrival of the excursion train. The flanges of the wheels of the derailed engine were found to have been in good condition and there is no evidence that the engine left the track first. So far as the officers of the road have been able to inspect the track, it is found that every tie had tie plates and that the rails were spiked to the ties with two spikes for each rail at each tie. Every joint was fully bolted and the rails and ties are reported as having been in good condition.

The track men who were on the ground gave assistance to the passengers at once, so far as they were able, and a train with eight physicians reached the scene of the accident within 40 minutes after it happened; other physicians arrived soon after. Both the Pennsylvania and the Lackawanna were energetic in giving assistance to the injured persons and to their friends who visited the scene.

Philadelphia-Washington Underground Telephone Line.

The American Telephone and Telegraph Company is laying an underground cable between Boston and Washington. The section between Philadelphia and Washington will be completed this year.

The conduit between the two cities is approximately 135 miles in length, which, added to the existing underground line between Philadelphia and New York, makes a total of about 235 miles. The wires used in these cables are larger than those employed on overhead lines and are so arranged that from each two pairs it is possible to obtain simultaneously three complete telephone and eight complete telegraph circuits. In addition there are contained within the cable sheath a number of pairs of smaller gage wires for use between intermediate cities along the route. These pairs of the small-gage wire may also be used for telegraph purposes. Altogether the cables contain 148 wires, which are arranged in 74 pairs and capable of giving 99 telephone and 296 telegraph communications simultaneously.

At intervals along the cable the wires are connected to Pupin "loading coils." Nearly 10,000 of these coils are to be used between Philadelphia and Washington and their aggregate weight will be about 200 tons.

On the section between Wilmington and Washington the trench in which the cable is being laid is about 100 miles in length and in the distance between the two cities there are 75 bridges over which the cables are to be carried. The manholes are 3 ft. wide by 4 ft. 6 in. long, and are placed at an average distance apart of about 500 ft. One thousand of these manholes will be constructed along the line between Philadelphia and Washington.

On one section of this line a trenching machine is used to excavate the trench. The machine is capable of digging daily a trench of 1,000 ft. long, 18 in. wide and 3 ft. deep. In the other sections a trench plow is used.—*Telegraph and Telephone Age.*

Paradise of Deadheads.

California still deals tenderly with people who have got used to traveling free—or rather it allows the railways still to deal loosely with such. The state railroad commission has announced the classification of persons who may be entitled to passes or reduced rates as follows: Ministers of religion, traveling secretaries of railway men's religious associations, executive officers, organizers or agents of railway employees' mutual benefit associations, inmates of hospitals and charitable and eleemosynary institutions, persons and property engaged or employed in patriotic work (when transportation is to be used for furtherance of such), persons and property engaged or employed in educational work or scientific research (when transportation is to be used for the furtherance of such, this authority not extending to persons employed by educational institutions which are run for profit), hotel employees of season resort hotels while traveling to and from such employment. In the case of representatives of executive officers of Chambers of Commerce and similar organizations, application is to be made to the commission who will act on such, such transportation to be for a furtherance of the work of the organization. By order of the commission all railway or other transportation companies are directed to furnish the commission quarterly reports giving details of all reduced or free transportation furnished.

American Society of Mechanical Engineers.

The headquarters of the American Society of Mechanical Engineers at its annual spring meeting, to be held in Pittsburgh, Pa., May 30-June 2, will be the Hotel Schenley, and all the professional sessions will be held in the lecture hall of the Carnegie Institute. The application of mechanical engineering to the field of cement manufacture will be one of the important questions considered. Among the papers presented there will be one on Edison Roll Crushers, by W. H. Mason, superintendent of the Edison Portland Cement Company, Stewartsville, N. J.; and one on Some Problems of the Cement Industry, by Walter S. Landis, associate professor of metallurgy at Lehigh University. A feature of the convention will be an excursion by special train to the plant of the Universal Portland Cement Company at Universal, Pa., on invitation of E. M. Hagar, president of the company. Other important topics will be Turbo-Compressors and Forging Presses. In addition to papers already mentioned, the professional sessions of the convention will deal with machine shop practice, with papers on the Assembling of Small Interchangeable Parts, by John Calder, manager of the Remington Typewriter Works, Ilion, N. Y.; the Process of Assembling Small and Intricate Parts, by Halcolm Ellis, of the Ellis Adding-Typewriter Company, Newark, N. J.; and the Design of Milling Cutters and their Efficiency, by A. L. DeLeeuw, mechanical engineer of the Cincinnati Milling Machine Company, Cincinnati, Ohio; also with Steel Works Practice, with papers on the Commercial Application of the Turbine Turbo-Compressor, by R. H. Rice of the General Electric Company, Schenectady, N. Y.; and upon Hydraulic Forging Pressors and Blowing Engines; and with miscellaneous topics, including papers on Stresses in Tubes, by Reid T. Stewart, professor of mechanical engineering of the University of Pittsburgh; the Purchase of Coal on the Heat Unit Basis, by Dwight T. Randall, engineer in charge of the fuel engineering department of Arthur T. Little, Inc., Boston, Mass.; Energy and Pressure Drop in Compound Steam Engines, by F. B. Cardullo, of the department of mechanical engineering of the New Hampshire College of Agriculture and the Mechanic Arts; and A Pressure Recording Indicator for Punching Machinery, by Gardner C. Anthony, dean of the engineering school of Tufts College. There will also be a session on Gas Power, with papers to be announced.

At the next regular meeting of this society, to be held in New York on May 9, several important papers on patents will be presented. The subject will be discussed by E. W. Marshall, D. Howard Haywood, Edwin J. Prindle, all of New York. The purpose of this meeting is to outline to the engineer and manufacturer the fundamental principles of the patent law, the position and qualifications of a patent expert and the industrial development for the purpose of establishing a patent monopoly.

Tool Foremen's Convention.

The annual convention of the American Railway Tool Foremen's Association will be held at the Wellington Hotel, Chicago, July 11-13. All steam and electric railway tool foremen should make a special effort to attend this meeting, as many subjects of mutual interest to the railways and tool foremen will be presented and discussed, and from numerous answers to a circular letter, sent out in January, there is no doubt that the coming convention will be the most enthusiastically attended of any yet held. It is expected that the meeting will be addressed by some of the most prominent superintendents of motive power in railway service. Following is the list of sub-

jects that will be discussed, besides papers sent in answer to circular letter: The Making of Dies for Forging Machines, by J. E. Roberts (C. C. C. & St. L.); H. E. Wright (Nat. of Mex.); and by H. E. Webb (S. A. L.); The Economical Use and Care of Emery Wheels, by H. E. Blackburn (Erie); Equipment of Railway Tool Rooms, by B. Hendrickson (C. & N. W.); Special Appliances for Use With Pneumatic Tools, by A. M. Roberts (B. & L. E.); W. A. Fairburn (N. Y. C. & H. R.); J. T. Fuhrman (G. N.); and by Mr. Brown (M. St. P. & S. S. M.); Standardizing Tools in Railway Tool Rooms, by E. J. McKernan (A. T. & S. F.); The Co-operation of the Shop Foremen and Tool Room Foreman in the Care and Maintenance of Small Tools, by W. J. Eddy (Erie). The supply men are planning to have many interesting exhibits. The secretary of the Tool Foremen's association is O. T. Harroun, Bloomington, Ill.

American Railway Association.

The spring session of the American Railway Association will be held at the United Engineering Society building, New York, on May 17. Reports will be presented by the Executive Committee and by the committees on Transportation, on Maintenance, on Relations between Railroads, on the Safe Transportation of Explosives and Other Dangerous Articles, on Electrical Working, and on Nominations. A second vice-president, two members of the Executive Committee, three members of the Committee on Transportation, three members of the Committee on Maintenance, three members of the Committee on Relations between Railroads and three members of the Committee on Nominations are to be elected at this meeting.

National Federation of Traffic and Transportation Clubs.

The National Federation of Traffic and Transportation Clubs was organized in Cincinnati, Ohio, on April 3. The object of the Federation is to give its members a more thorough knowledge of transportation problems, to encourage the organization of additional traffic clubs throughout the country, and to promote harmonious co-operation. The officers are as follows: President, J. V. Zartman, president of the Zartman Oil Company, Indianapolis, Ind.; vice-presidents, Thomas Conlon, Michigan Central; James L. Marens, St. Louis Southwestern; and Walter G. Norvell, traffic manager, Parke-Davis & Co., Detroit, Mich.; secretary and treasurer, Carl K. Landes, Canadian Pacific, Cincinnati, Ohio.

Association of American Railway Accounting Officers.

The twenty-third meeting of the Association of American Railway Accounting Officers was held at the Grunewald Hotel, New Orleans, La., April 26 and 27. The following officers were elected for the ensuing year: President, L. A. Jones (Q. & C.); first vice-president, M. P. Blauvelt (I. C.); second vice-president, C. W. Bunting (Pennsylvania); secretary, C. G. Phillips, 143 Dearborn street, Chicago. A further account of this meeting is published in another column.

American Society of Civil Engineers.

At the meeting of the American Society of Civil Engineers, held on May 3, a paper entitled Sinking a Wet Shaft, by John P. Hogan, Jun. Am. Soc. C. E., was presented for discussion. This paper was printed in the *Proceedings* for March, 1911.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.; annual convention, May 23-26, Chicago.

American Association of Demurrage Officers.—A. G. Thomason, Scranton, Pa.; next meeting, June 22, 1911, Niagara Falls, N. Y.

American Association of General Passenger and Ticket Agents.—C. M. Burt, Boston, Mass.; next meeting, St. Paul, Minn., Sept. 19, 1911.

American Association of Freight Agents.—R. O. Wells, East St. Louis, Ill.; June 20-23, Kansas City, Mo.

American Association of Railroad Superintendents.—O. G. Fetter, Carew building, Cincinnati, Ohio; 3d Friday of March and September.

American Electric Railway Association.—H. C. Donecker, 29 W. 39th St., New York.

American Railway Association.—W. F. Allen, 24 Park Place, New York; May 17, New York.

American Railway Bridge and Building Association.—C. A. Lichty, C. & N. W., Chicago; Oct. 17-19, 1911, St. Louis, Mo.

American Railway Engineering Association.—E. H. Fritch, Monadnock Block, Chicago.

American Railway Industrial Association.—G. L. Stewart, St. L. S. W. Ry., S. Louis, Mo.; May 9-10, 1911, Detroit, Mich.

American Railway Master Mechanics' Association.—J. W. Taylor, Old Colony building, Chicago; June 14-16, 1911, Atlantic City, N. J.

American Railway Tool Foremen's Association.—O. T. Harroun, Bloomington, Ill.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.; June 27-July 1, Atlantic City, N. J.

American Society of Civil Engineers.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wed., except June and August, New York.

American Society of Engineering Contractors.—D. J. Haner, 13 Park Row, New York; 3d Tuesday of each month, New York.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York; next convention, May 30-June 2, Pittsburgh, Pa.

Association of American Railway Accounting Officers.—C. G. Phillips, 143 Dearborn St., Chicago.

Association of Railway Claim Agents.—J. R. McSherry, C. & E. I., Chicago; May 24-26, Montreal, Can.

Association of Railway Electrical Engineers.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago; semi-annual, June 16-17, Washington, D. C.

Association of Railway Telegraph Superintendents.—P. W. Drew, 135 Adams St., Chicago; June 19, 1911, Boston, Mass.

Association of Transportation and Car Accounting Officers.—G. P. Conard, 24 Park Pl., New York; June 20-21, Cape May City, N. J.

Canadian Railway Club.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tuesday in month, except June, July and Aug., Montreal.

Canadian Society of Civil Engineers.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursdays, Montreal.

Car Foremen's Association of Chicago.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.

Central Railway Club.—H. D. Vought, 95 Liberty St., New York; 2d Thurs. in Jan., and 2d Fri. in March, May, Sept., Nov., Buffalo, N. Y.

Civil Engineers' Society of St. Paul.—D. F. Jurgensen, 116 Winter St., St. Paul, Minn.; 2d Monday, except June, July and Aug., St. Paul.

Engineers' Society of Pennsylvania.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.

Engineers' Society of Western Pennsylvania.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.

Freight Claim Association.—Warren P. Taylor, Richmond, Va.; June 21, St. Paul, Minn.

General Superintendents' Association of Chicago.—H. D. Judson, 209 East Adams St., Chicago; Wed. preceding 3d Thurs., Chicago.

International Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., New York; May 23-26, Omaha, Neb.

International Railway Congress.—Executive Committee, rue de Louvain, 11 Brussels; 1915, Berlin.

International Railway Fuel Association.—D. B. Sebastian, La Salle St. Station, Chicago; May 15-18, 1911, Chattanooga, Tenn.

International Railway General Foremen's Association.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; July 25-27, Chicago.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio.

Iowa Railway Club.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August, Des Moines.

Master Car Builders' Association.—J. W. Taylor, Old Colony building, Chicago; June 19-21, 1911, Atlantic City, N. J.

Master Car and Locomotive Painters' Association, of United States and Canada.—A. P. Dane, B. & M., Reading, Mass.; Sept. 12-15, 1911, Atlantic City, N. J.

New England Railroad Club.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.

New York Railroad Club.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.

Northern Railway Club.—C. L. Kennedy, C., M. & St. P., Duluth, Minn.; 4th Saturday, Duluth.

Omaha Railway Club.—H. H. Maulick, Barker Block, Omaha, Neb.; second Wednesday.

Railroad Club of Kansas City.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.

Railway Club of Pittsburgh.—C. W. Alleman, P. & L. E., Pittsburgh, Pa., 4th Friday in month, except June, July and August, Pittsburgh.

Railway Signal Association.—C. C. Rosenberg, Bethlehem, Pa.; June 13, New York; annual, Oct. 10, Colorado Springs, Colo.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio; annual, May 22-24, 1911, Milwaukee, Wis.

Richmond Railroad Club.—F. O. Robinson, Richmond, Va.; 2d Monday, except June, July and August.

Roadmasters' and Maintenance of Way Association.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Oct., 1911, St. Louis.

St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis.

Society of Railway Financial Officers.—C. Nyquist, La Salle St. Station, Chicago; Sept. 12-14, St. Paul, Minn.

Southern Association of Car Service Officers.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.

Southern & Southwestern Railway Club.—A. J. Merrill, Grant bldg., Atlanta, Ga.; 3d Thurs., Jan., March, May, July, Sept., Nov., Atlanta.

Toledo Transportation Club.—L. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday, Toledo.

Traffic Club of Chicago.—Guy S. McCabe, La Salle Hotel, Chicago; meetings monthly, Chicago.

Traffic Club of New York.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August, New York.

Traffic Club of Pittsburgh.—T. J. Walters, Oliver building, Pittsburgh, Pa.; meetings monthly, Pittsburgh.

Train Despatchers' Association of America.—J. F. Mackie, 7042 Stewart Ave., Chicago; annual, June 20, 1911, Baltimore, Md.

Transportation Club of Buffalo.—J. M. Sells, Buffalo; first Saturday after first Wednesday.

Transportation Club of Detroit.—W. R. Hurley, L. S. & M. S., Detroit, Mich.; meetings monthly.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.; annual, August 29-September 1, Chicago.

Western Canada Railway Club.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.

Western Railway Club.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except, June, July and August.

Western Society of Engineers.—J. H. Warder, 1735 Monadnock Block, Chicago; 1st Wednesday in month except July and August, Chicago.

Wood Preservers' Association.—F. J. Angier, First National Bank bldg., Chicago.

Traffic News.

The governor of Michigan has signed the bill passed at the session of legislature just closed, reducing passenger rates in the upper peninsula to two cents a mile.

The Frank Parmelee Transfer Company has purchased 30 motor carriages of the style of limousine cars to use in its cab service between the different railway passenger stations in Chicago.

New York City taxicab companies have raised their rates from 70 to 80 cents a mile. Take one across the river to New Jersey by the ferry and give the Interstate Commerce Commission a chance to butt in.—*Wall Street Journal.*

The Chicago, Rock Island & Pacific on May 14 will inaugurate through passenger service between St. Paul, Minn., and Des Moines, Iowa, over the St. Paul & Des Moines, which it recently acquired and which provides a more direct line between those points. Construction is also under way which will result in a shorter line for the Rock Island between St. Paul and Kansas City.

Alexander Hilton, general passenger agent of the St. Louis & San Francisco, has been elected president of the St. Louis Traffic Club, succeeding Carl R. Gray, who recently went to Portland, Ore., as president of the Spokane, Portland & Seattle. B. M. Flippin, freight traffic manager of the Missouri Pacific, has been elected to succeed C. S. Clarke as vice-president of the club.

The Pennsylvania now runs a local Trenton passenger train to and from the new station in New York City. The new train leaves Trenton in the morning and returns to Trenton in the afternoon. It will be recalled that hitherto the new station has been used only by through trains; the local trains continuing to run to and from Jersey City, except in the case of the Long Branch express and one or two night trains.

The Agricultural College of the Ohio State University has announced that germination tests show that seed corn for planting this year is exceedingly low in vitality. As a consequence, the Pennsylvania Company, co-operating with the State College authorities, is to operate a "Corn Special" train across the state to give farmers instruction in corn breeding and cultivation. The Pennsylvania will furnish and operate the train free of cost to any one, as it has disseminated literature, established experiment stations, and given lessons in making good roads.

Three-cent Fares in Florida.

The Louisville & Nashville has notified the governor, the attorney-general and the railway commission of Florida, that beginning May 8, all passenger fares in that state will be made three cents a mile. At present the fares on this road in Florida are four cents a mile. The railway commission has been prosecuting a case in the courts for several years past, with a view to forcing a reduction, and a bill to compel the reduction has been favorably considered by the legislature at the present session.

The Indictment Against the Pennsylvania.

In view of the recent indictment against the Pennsylvania Company in Cleveland, and of apparent misunderstanding, the following statement is made by President James McCrea:

"The action of the Grand Jury, so far as I understand it, is based on the following condition of affairs: During the year 1908, and a portion of the year 1909, iron ore was landed from vessels at docks on Lake Erie belonging to the Pennsylvania Company, which docks were being operated by M. A. Hanna & Co. as a dock company, with whom an agreement was entered into for handling ore from the vessels to the cars and docks of the railway company. The vessels paid a fixed price per ton for unloading, and the railway company a fixed price per ton for loading the ore on the cars, the prices thus established being the current prices at practically all of the docks of all railways at Lake Erie ports.

"Owing to the introduction of improved ore handling machinery during this period, the cost of handling the ore was found to be less than the sum of the payments made to the dock companies by the vessels and the railway companies, but the exact amount of this possible saving could not be determined until the close of the season. It was therefore provided in the agreement that after deducting from the gross receipts of the dock company, rental, cost of operation and maintenance, and proper remuneration for services rendered, that portion of the saving per ton published in the tariffs of the railway company, filed with the Interstate Commerce Commission, was to be paid currently by the dock company to the consumers of ore, and any additional surplus or saving that might possibly remain at the close of the year should also be apportioned among the consumers of ore in the proportion that the ore received by them over the Pennsylvania Company's lines and connections bore to the total ore tonnage forwarded from the Pennsylvania Company docks. This, of course, absolutely insured uniform rates to all consumers of ore forwarding from those docks.

"The tariffs duly published and filed with the Interstate Commerce Commission showed clearly the current payments to be made by the dock company to all these consumers of ore, but appear to have been silent as to the final distribution to be made by the dock company of any possible additional saving; consequently, if in the company's effort to carry out the exact spirit of the law and insure impartial treatment to its patrons, the failure to note in the published tariffs the provision for the final distribution of the possible additional saving (of which every consumer had not only knowledge but notice) was not strictly in accordance with the law, the violation was only technical and wholly unintentional.

"There can be no question of discrimination involved, as all consumers, both large and small, were treated with strict impartiality; there never was nor could be any favoritism, for the rate to each one was exactly the same.

"The indictment of Mr. Hanna, president of the dock company, and of Mr. McCabe, vice-president of the railway company, for alleged conspiracy, appears to be due solely to the fact that it was they who executed, on behalf of their respective companies, this contract by which exact and absolute equality of rates to all consumers of ore forwarded from Pennsylvania Company's docks was guaranteed."

Uniform Baggage Rules.

Uniform rules for the handling of baggage went into effect on all the railways of the United States and Canada on May 1. Heretofore there have been considerable diversities in the rules of the railways in different parts of the country. Changes have been made in the more important rules and also in numerous details.

One of the important changes relates to the handling of corpses. The rules of the eastern and western lines have heretofore been so different that passengers accompanying corpses have had to leave trains at Gateways between east and west and re-check them. In many instances the passenger has arrived at a junction ahead of the corpse and had to stay over in order to wait for it. Under the new system the corpse is checked through to any destination in the United States or Canada, the ticket for it being endorsed with the number of the baggage check and the baggage check being endorsed with the number of the attendant's ticket, thus preventing confusion. The maximum permitted weight of caskets and their contents is 500 lbs. All weight in excess of this will be charged for at excess baggage rates.

There has been a good deal of controversy in the past between railways and travelers as to what constitutes baggage. The rules of some roads have been rather broad and those of others rather narrow. The most serious controversies have arisen over the carrying of commercial travelers' samples as baggage. Under the new rules there are two kinds of baggage—personal and sample. Personal baggage is wearing apparel, toilet articles and similar effects in actual use and necessary and appropriate for the wear, use, comfort and convenience of the passenger for the purpose of the journey, and not intended for other persons or for sale. Money, jewelry, negotiable paper, liquids, perishable articles, etc., are excluded, and the railways refuse to be liable for damage caused to or by them. Sample baggage is defined as samples of merchandise carried by commercial travelers with the view of enabling them to make sales of goods similar to the samples carried, and not for sale or free distribution by the owner or owners, branch houses, customers or others. This rule is made to include samples carried by "commercial

travelers," but to exclude goods carried by peddlers. Money, jewelry, negotiable papers, etc., are not allowed to be carried as sample baggage.

Under the rules heretofore in effect the contracts on passengers' tickets limited the baggage liability of the roads to $100. Under the new contracts the limit on an adult's baggage will be $100 and on that of a child $50. If the passenger declares a greater valuation, excess baggage rates will be charged at 10 per cent. of excess baggage rates per 100 lbs. for the distance the baggage is to move. For example, if the excess baggage rate per 100 lbs. were $1 the railway would charge 10 cents for each $100 of valuation in excess of $100. No piece of baggage for one passenger which is declared to exceed $5,000 in value will be accepted.

Dogs heretofore have been carried by the western lines as baggage free at owner's risk. The eastern roads have had more strict rules regarding their transportation. The eastern rule, with some modifications, has been adopted by all lines. Under the new arrangement dogs not exceeding $25 in value, or not for exhibition or field trials, if muzzled, or in crates, so marked as to show the name and address of the owner, and accompanied by owner, will be checked and charged for at the regular excess baggage rate for the gross weight, the minimum charge being 25 cents. In all other cases dogs will be turned over to the express companies for transportation.

One of the most important changes is to take effect next January. Under the present rules no piece of baggage will be checked which contains more than 40 cu. ft. and weighs more than 250 lbs. After the date mentioned an excess rate will be charged for any piece the greatest dimension of which exceeds 40 in. For each inch of any dimension in excess of 40 in. a charge will be made equal to the charge for 10 lbs. of excess baggage, and no piece whose greatest dimension exceeds 70 in. will be accepted at all, unless it be immigrant baggage checked at a port of landing.

The purpose of these rules is to eliminate entirely the large trunks in which a great deal of baggage—especially sample baggage—is now handled. The capacity of baggage cars is not unlimited and a good many of the large trunks now used have such great dimensions in one way or another that it is impossible to pile them so as to get efficient loading.

INTERSTATE COMMERCE COMMISSION.

The commission has ordered a further suspension of tariffs filed by southwestern roads, changing or abolishing their allowances to the Manufacturers' Railway of St. Louis. These tariffs had been suspended until May 1, and now they are put over until August 28.

The commission last week held hearings to take evidence on the suitableness of the regulations of the American Railway Association for the transportation of inflammable articles and acids. A representative of a number of dealers in petroleum objected to some clauses of the rules.

The commission has denied the application of the New York, Ontario & Western for relief from the fourth section of the law with respect to rates on anthracite coal from the mines to Port Jervis, N. Y.; also the application of the Rock Island for relief from the fourth section on coal, cement and salt from Kansas City to Watonga, Okla.

At Boston last week, Commissioner Lane gave an extended hearing on the question of freight car demurrage. Some months since, the commission ordered the standard demurrage rules established in New England, but permitted the temporary or experimental allowance of 72 hours' free time on lumber and grain. At the hearing Commissioner Lane told the merchants and shippers of Boston that he saw no reason why New England should be treated differently from the rest of the country, and especially none to justify the allowance of 96 hours' free time on shipments of cotton.

Advanced Rates on Cement Refused.

In re Investigation of Advances in Rates on Cement by Carriers in Trans-Missouri Territory. Opinion by Commissioner McChord:

The principal railways in trans-Missouri territory filed with the commission tariffs which were to become effective September 1, 1910, containing new rates on cement from what is known as the gas belt in eastern Kansas and Oklahoma, and embracing such points as Iola and Chanute, Kans., but extending as far north as Sugar Creek, Mo., in the neighborhood of Kansas City, and as far south as Dewey, Okla., to points in Colorado, Kansas, Nebraska, and in other states embracing a wide range of territory, reaching from Illinois on the east into practically all trans-Missouri and intermountain territory. They also filed tariffs naming advances from Portland, Colo., to points chiefly in Colorado, Nebraska, Kansas and Wyoming. These tariffs are now suspended until July 1, 1911, pending investigation. The proposed rates are not condemned between the following points of origin and destination, viz., Portland, Colo., to all destinations; Kansas City territory and points in Kansas and Oklahoma to points in Texas, as contained in Southwestern Lines Tariff, I. C. C. No. 737, Sup. No. 6; and from Bonner Springs, Kans., and Yocemento, to various points in the states of Colorado, Iowa, Kansas, Missouri, Nebraska, Wyoming, and New Mexico, as contained in tariffs I. C. C. Nos 2318 (Sup. No. 2), 2346, and 2348 of the Union Pacific. With these exceptions, the propriety of the new rates and charges has not been shown.

It does not appear that such of the present cement rates as it is held should not be advanced fail to pay their due proportion of the general burden of transportation. Some of them are now materially higher than they were for a long period, during which there was a considerable movement and the business had adjusted itself thereto.

The railways publishing said tariffs are requested to withdraw them forthwith. If such action be not taken before May 15, 1911, the commission will issue an order directing the maintenance of the present rates for a period of two years from that date. (20 I. C. C. 588.)

STATE COMMISSIONS.

The Board of Public Utility Commissioners of New Jersey has been reorganized by the appointment of Prof. Winthrop Daniel of Princeton, in place of Frank H. Sommer, and by the election of Robert Williams as president of the board.

Carl C. Witt, who was engineer of the South Dakota railway commission during the time the appraisal of the railway property in that state was made, has been appointed engineer of the reorganized public utilities commission of Kansas at a salary of $4,500 a year.

COURT NEWS.

Judge Sanborn at St. Paul has granted the petition of the state of Minnesota for an appeal to the Supreme court of the United States in the Minnesota rate cases.

At Fort Smith, Ark., April 28, the Fort Smith & Western was fined $18,250 on a charge of violating the state law requiring the provision of buildings or shelters for the protection of men repairing cars.

The United States Circuit Court of Appeals at Cincinnati has declared void the action of the Ohio Railroad Commission in reducing, from 90 cents a ton to 70 cents, the rate on coal over the Wheeling & Lake Erie to Lake Erie ports. The coal in question was destined (by boat) to other ports on the upper lakes and the court held that it was an article of interstate commerce.

In the United States Circuit Court May 3 Judge Trieber handed down his opinion in the Arkansas rate cases making permanent the temporary injunctions granted by Judge Van Devanter, restraining the Arkansas state railway commission from enforcing the 2 cent fare and reduced freight rate law. The court finds that the net earnings from all state traffic, freight and passenger, are less than 1 per cent. for the St. Louis, Iron Mountain & Southern, and 2¼ per cent. for the St. Louis Southwestern. These earnings the court finds to be non-compensatory and in effect confiscatory. The court holds that a railway built in pursuance of public demand through a fertile section of the country, rich in timber and other valuable resources, economically managed, is entitled to a return of 6 per cent. on its actual investment or physical valuation, provided the rates to enable it to secure such returns do not have to be so high as to be oppressive to those who from necessity are compelled to employ its services.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF FEBRUARY, 1911. (SEE ALSO ISSUES APRIL 14, 21 AND 28.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama & Vicksburg	143	$90,628	$32,717	$135,758	$18,687	$28,355	$3,332	$47,027	$5,653	$103,054	$32,704	$187	$4,490	$28,401	—$11,349
Arizona Eastern	364*	90,397	31,850	129,582	50,389	11,177	1,731	36,515	3,483	103,295	26,287	185	6,944	19,528	—51,203
Bessemer & Lake Erie	204	296,375	18,917	322,450	40,468	129,226	7,113	122,489	8,690	307,986	14,464	.....	6,000	8,464	31,146
Carolina, Clinchfield & Ohio	236†	138,471	9,725	151,449	12,909	21,251	5,481	32,973	8,960	81,574	69,875	1,433	5,500	65,808	37,142
Carolina, Clinchfield & Ohio of S. C.	18	7,560	1,251	9,062	540	131	1,054	2,043	527	4,295	4,767	.....	200	4,567	—
Central New England	277	185,975	21,491	224,678	32,675	19,504	1,319	67,117	3,466	124,081	100,597	.....	19,000	81,597	—7,997
Chesapeake & Ohio of Indiana	285	80,595	13,500	100,087	33,815	35,131	6,027	73,212	5,899	154,084	—53,997	56	3,790	—57,731	—
Chicago & Erie	270	304,116	50,650	399,103	32,259	89,253	19,631	209,763	10,068	366,974	38,129	.....	11,387	26,742	—94,840
Chicago, Peoria & St. Louis	255	98,035	19,277	124,083	15,718	28,689	6,961	60,340	6,017	117,725	6,358	.....	4,500	1,858	—9,513
Chicago, Terre Haute & Southeastern	351‡	107,670	14,308	123,616	10,782	26,630	3,160	44,120	7,734	92,426	31,190	56	8,700	22,546	—
Cleveland, Akron & Columbus	212	125,398	38,741	178,599	25,517	38,783	3,281	64,853	3,226	135,660	42,939	.....	8,500	34,439	—9,907
Colorado Midland	337	84,562	17,376	117,971	14,206	29,130	4,691	61,240	5,966	115,233	2,738	—1,217	8,500	—6,979	2,621
Cumberland Valley	162	159,004	42,472	213,565	19,627	29,362	3,564	76,693	5,736	134,982	78,583	127	5,141	73,569	—7,257
Detroit, Grand Haven & Milwaukee	190	97,349	31,268	154,619	19,701	26,654	6,795	99,031	4,830	157,011	—2,392	—65	3,009	—5,466	—42,811
Duluth & Iron Range	191§	105,982	23,218	138,311	46,618	43,500	398	81,523	8,552	180,591	—42,280	—2,756	10,919	—55,955	3,764
Duluth, Missabe & Northern	316¶	91,001	34,449	129,773	69,146	82,867	1,574	85,226	11,609	250,422	—120,649	—1,140	5,279	—127,068	—62,566
Georgia Southern & Florida	395	121,250	64,699	209,379	20,918	40,597	6,198	78,609	8,681	155,003	54,375	.....	9,157	45,218	12,607
Grand Trunk Western	347	336,408	112,956	478,312	31,369	78,026	17,254	244,054	12,991	383,694	94,618	—1,583	31,697	61,338	—64,091
Gulf & Ship Island	307	118,662	27,869	159,024	20,429	32,068	1,295	52,241	7,428	113,461	45,563	.....	4,995	40,568	5,686
Kanawha & Michigan	175	157,381	25,360	187,541	16,915	36,440	1,854	59,124	7,321	121,654	65,887	1	7,081	58,807	14,324
Louisiana & Arkansas	255	102,559	12,662	118,994	17,113	16,107	2,304	33,575	4,436	73,535	45,459	.....	2,825	42,634	11,787
Louisiana Ry. & Nav. Co.	351	94,870	18,224	122,372	18,955	17,122	4,837	55,872	5,591	102,377	19,995	.....	4,400	15,595	5,499
Louisiana Western	207	103,123	61,542	172,525	20,557	25,877	7,084	52,385	8,365	114,258	58,257	884	6,577	52,564	9,419
Midland Valley	324	61,366	32,655	100,808	20,723	15,633	2,280	33,543	5,871	78,050	22,758	940	5,475	18,223	—16,491
Minneapolis, St. Paul & S. S. Marie	3,764‖	1,155,197	261,758	1,521,231	149,226	252,683	36,405	715,041	42,366	1,195,721	325,510	—2,873	80,260	242,377	—126,416
Missouri Pacific	3,920*a*	1,150,718	314,836	1,661,404	276,417	282,861	56,971	938,818	73,885	1,628,952	32,452	—5,486	83,500	—56,534	—266,327
New Orleans & Northeastern	196	208,490	56,216	291,928	30,496	52,067	8,442	106,102	11,385	208,492	83,436	—727	8,550	74,159	—22,950
New Orleans Great Northern	282	103,575	27,581	141,799	15,282	20,010	2,853	45,650	5,525	89,321	52,478	—175	2,471	49,832	—1,998
New York, Philadelphia & Norfolk	112	187,460	24,456	229,907	30,674	45,969	2,712	102,259	11,670	193,284	36,623	.....	7,500	29,123	—23,893
New York, Susquehanna & Western	152	164,832	40,962	231,380	19,992	22,138	1,914	84,622	3,431	132,097	99,283	—1,507	11,771	86,005	9,220
St. Joseph & Grand Island	319	66,785	30,209	107,180	17,237	20,237	6,220	56,436	6,669	106,799	381	15	5,711	—5,315	15,232
St. Louis, Iron Mountain & Southern	3,316*b*	1,624,677	465,759	2,272,677	295,121	290,916	52,566	808,721	81,338	1,528,662	744,015	—8,128	78,916	656,971	173,471
Tennessee Central	294	81,077	25,645	104,029	15,813	16,647	4,312	40,410	7,150	84,332	29,697	.....	3,980	25,717	679
Trinity & Brazos Valley	463	109,138	25,374	139,119	28,262	20,885	8,191	75,322	11,807	144,467	—5,348	.....	3,500	—8,848	—2,922
Vicksburg, Shreveport & Pacific	171	64,434	33,259	109,949	24,505	19,028	3,324	35,090	4,711	86,658	23,291	—219	6,175	16,897	—5,855
Western Maryland	543	405,518	50,977	476,436	37,177	59,492	7,474	183,921	13,807	301,871	174,565	—401	19,500	154,664	—72,802
EIGHT MONTHS OF FISCAL YEAR 1911.															
Alabama & Vicksburg	143	$789,014	$345,229	$1,225,553	$160,968	$203,761	$29,641	$410,150	$42,875	$847,395	$378,158	$193	$37,426	$340,925	$8,757
Arizona Eastern	364*	750,278	263,498	1,086,269	223,971	98,671	15,440	305,249	31,632	674,963	411,306	—80	48,875	362,351	—22,076
Bessemer & Lake Erie	204	4,679,695	255,090	5,010,454	609,880	1,065,471	62,093	1,426,421	96,224	3,260,089	1,750,365	.....	74,209	1,676,156	—672,094
Carolina, Clinchfield & Ohio	236†	963,321	109,095	1,103,108	105,590	153,887	43,937	243,172	66,673	613,259	489,849	1,983	44,000	447,832	237,653
Carolina, Clinchfield & Ohio of S. C.	18	53,269	12,001	67,331	4,817	587	7,441	18,500	4,328	35,673	31,658	.....	1,600	30,058	—
Central New England	277	1,735,282	239,492	2,087,665	412,477	181,706	15,513	614,101	24,744	1,248,541	839,124	.....	92,000	747,124	—23,232
Chesapeake & Ohio of Indiana	285	804,327	192,998	1,051,131	254,632	210,248	48,742	571,286	40,270	1,125,178	—74,047	56	30,320	—104,311	—
Chicago & Erie	270	2,647,157	546,802	3,502,231	396,115	733,017	162,921	1,587,090	76,703	2,955,846	546,385	.....	90,650	455,735	—168,007
Chicago, Peoria & St. Louis	255	934,321	214,855	1,207,486	180,340	257,910	58,237	548,200	46,581	1,091,268	116,218	.....	36,000	80,218	—131,500
Chicago, Terre Haute & Southeastern	351‡	237,242	29,377	270,536	28,231	56,707	6,047	103,535	16,510	211,030	59,506	—94	17,400	42,012	—
Cleveland, Akron & Columbus	212	1,289,971	397,683	1,807,139	321,779	300,319	24,920	605,890	31,891	1,284,799	522,340	.....	71,000	451,340	68,821
Colorado Midland	337	980,048	234,773	1,374,534	176,039	291,478	39,686	598,490	45,211	1,150,904	223,630	—3,904	66,382	153,344	—91,757
Cumberland Valley	162	1,544,950	442,365	2,083,025	235,753	276,966	37,969	659,188	52,409	1,262,285	820,740	2,238	44,165	778,813	—20,992
Detroit, Grand Haven & Milwaukee	190	785,171	384,999	1,360,743	190,791	173,063	50,872	680,142	36,447	1,131,315	229,428	—305	24,072	205,051	—141,273
Duluth & Iron Range	191§	5,080,339	208,424	5,365,799	533,608	458,937	3,827	1,169,828	104,586	2,270,786	3,095,013	7,480	263,352	2,839,141	—1,184,813
Duluth, Missabe & Northern	316¶	7,362,966	320,534	7,735,866	810,814	758,124	13,398	1,196,110	118,396	2,896,842	4,839,024	47,514	389,270	4,497,269	—1,511,906
Georgia Southern & Florida	395	881,374	543,585	1,637,914	176,894	331,368	48,466	607,298	72,028	1,236,054	401,860	.....	75,318	326,542	—17,473
Grand Trunk Western	347	2,553,292	1,313,833	4,138,852	407,500	601,225	145,135	1,782,261	104,534	3,040,655	1,098,197	—9,540	253,579	835,078	—218,194
Gulf & Ship Island	307	972,257	282,239	1,348,276	165,749	235,930	13,245	384,763	63,296	862,983	485,293	.....	39,759	445,534	58,876
Kanawha & Michigan	175	1,829,103	242,864	2,117,038	221,826	375,668	18,357	585,670	55,057	1,256,578	860,460	—90	61,648	798,722	296,530
Louisiana & Arkansas	255	797,533	129,020	963,423	154,028	133,075	19,599	257,586	35,828	600,116	363,307	.....	21,400	341,907	47,302
Louisiana Ry. & Nav. Co.	351	881,034	162,938	1,144,268	198,134	137,031	39,528	470,902	49,166	894,761	249,507	.....	35,200	214,307	73,801
Louisiana Western	207	896,043	446,316	1,408,248	184,443	200,085	50,337	416,004	60,285	911,154	497,094	51	56,526	440,619	—46,848
Midland Valley	324	560,767	272,409	884,103	161,598	136,131	17,415	258,052	57,360	630,556	253,547	8,730	43,804	218,473	—6,253
Minneapolis, St. Paul & S. S. Marie	3,764‖	10,393,714	3,371,707	14,724,051	1,499,188	2,078,676	341,187	5,482,001	327,265	9,728,317	4,995,734	89,809	807,791	4,277,752	—2,114,768
Missouri Pacific	3,920*a*	11,758,535	3,226,439	16,718,449	2,620,755	2,676,087	475,056	7,694,961	562,409	14,029,268	2,689,181	—22,218	668,000	1,998,963	—
New Orleans & Northeastern	196	1,823,691	426,929	2,411,282	242,211	370,175	73,078	853,073	92,422	1,630,959	780,323	—1,039	69,887	709,397	10,329
New Orleans Great Northern	282	770,873	250,923	1,115,752	165,839	154,578	24,555	317,162	40,424	702,558	413,194	—758	15,621	396,815	64,728
New York, Philadelphia & Norfolk	112	1,790,481	284,678	2,243,556	248,264	375,552	35,036	866,344	89,448	1,614,644	628,913	.....	61,650	567,263	—85,728
New York, Susquehanna & Western	152	1,321,026	403,536	1,938,694	227,449	181,529	16,299	715,850	33,670	1,174,796	763,898	1,243	93,715	671,426	118,423
St. Joseph & Grand Island	319	755,970	314,089	1,164,493	248,491	162,145	52,022	503,515	49,925	1,016,098	148,395	288	47,613	101,071	—32,506
St. Louis, Iron Mountain & Southern	3,316*b*	13,536,854	4,153,561	19,209,795	2,868,601	2,532,695	446,374	6,528,961	612,815	12,989,446	6,220,349	29,027	629,368	5,561,954	19,165
Tennessee Central	294	671,592	268,519	998,005	142,243	106,061	38,592	309,083	64,794	660,773	337,232	.....	31,841	305,391	14,486
Trinity & Brazos Valley	463	1,172,699	258,995	1,488,600	265,834	241,839	63,926	660,642	89,442	1,321,683	166,917	.....	29,185	137,732	21,626
Vicksburg, Shreveport & Pacific	171	617,380	339,102	1,037,458	158,537	171,326	26,943	312,326	36,424	705,556	331,902	—595	47,200	284,107	54,669
Western Maryland	543	3,930,895	686,747	4,821,145	550,137	575,510	74,485	1,684,864	106,856	2,991,852	1,829,293	—2,852	156,000	1,670,441	—

Mileage operated on February 28, 1910.—* 312 miles; † 225 miles; § 168 miles; ¶ 293 miles; ‖ 3,533 miles; *a* 3,883 miles; *b* 3,287 miles; — indicates deficits, losses and decreases.
‡ Began operations on January 1, 1911.

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

W. P. Wissmann, auditor of the Wisconsin & Michigan, at Chicago, has had his office moved to Peshtigo, Wis.

C. S. Vidor, president; C. W. Hole, general manager, and other officers of the Peach River Lines, have removed their offices from Galveston, Tex., to Beaumont.

T. J. Maloney has been appointed auditor of the Illinois Northern; Chicago, West Pullman & Southern; Deering Southwestern and the Owasco River Railway, with office at Chicago.

A. S. Halsted, assistant general counsel of the San Pedro, Los Angeles & Salt Lake at Los Angeles, Cal., has been appointed general counsel, with office at Los Angeles, succeeding W. R. Kelly, deceased.

Operating Officers.

E. W. Mason, car accountant and superintendent of telegraph of the Western Pacific, at San Francisco, Cal., has been appointed superintendent, with office at Sacramento, succeeding J. W. Mulhern, promoted.

George H. Barnes, trainmaster of the Denver, Northwestern Pacific, has been appointed superintendent, with office at Utah Junction, Colo. W. C. Hollister succeeds Mr. Barnes, with office at Utah Junction.

W. J. Stoneburner, superintendent of the Missouri, Kansas & Texas of Texas, at Denison, Texas, has been appointed general manager of the Texas City Terminal Railway, with office at Texas City, Texas.

J. W. Mulhern, superintendent of the Western Pacific, at Sacramento, Cal., has been appointed general superintendent of the Denver & Rio Grande, with office at Salt Lake City, Utah, succeeding J. C. Dailey, deceased.

William N. Neff, superintendent of the Eastern Texas and the St. Louis Southwestern of Texas, at Mount Pleasant, Texas, has been appointed general superintendent of the St. Louis Southwestern and the St. Louis Southwestern of Texas, with office at Tyler, succeeding J. W. Maxwell, deceased.

J. M. Flannigan, terminal trainmaster of the St. Louis & San Francisco at Kansas City, Mo., has been appointed superintendent of terminals, with office at Kansas City, Mo. F. G. Fulkner has been appointed an assistant superintendent, with office at Sapulpa, Okla., succeeding C. F. Hopkins, who has been made chief clerk to W. T. Tyler, general manager.

B. B. Greer, superintendent of terminals of the Chicago, Burlington & Quincy, at St. Louis, Mo., has been appointed superintendent of the Hannibal division, with office at Hannibal, succeeding A. N. Willsie, transferred. Mr. Greer's former position has been abolished, and the St. Louis terminals will hereafter be operated as a part of the Hannibal division. T. K. Knight has been appointed assistant superintendent of the Hannibal division, with office at St. Louis.

W. H. Coppage has been appointed trainmaster of the Louisiana Railway & Navigation Company, with jurisdiction over the entire line, and H. L. Graham has been appointed assistant trainmaster, both with offices at Shreveport, La. O. H. Wilson, trainmaster of the Western division, at Shreveport, has resigned on account of climatic conditions, which made it impossible for him to remain longer in the southern states. Mr. Wilson is leaving railway service after 40 years with this company, the Rock Island Lines and the Burlington.

F. L. Sheppard, general superintendent of the New Jersey division of the Pennsylvania Railroad, at Jersey City, N. J., has had his authority extended over the West Jersey & Sea Shore Railroad and the Philadelphia & Camden Ferry Company, with office at Jersey City. A portrait of Mr. Sheppard and a sketch of his career were published in the *Railway Age Gazette*, June 17, 1910, page 1565. J. T. Wallis, superintendent of motive power of the Erie division of the Pennsylvania Railroad and the Northern Central Railway, at Williamsport, Pa., has been promoted to superintendent of the West Jersey & Sea Shore and the Philadelphia & Camden Ferry Company, with office at Camden, N. J., succeeding D. H. Lovell, granted extended leave of absence.

J. P. Cantillon, division superintendent of the Chicago & North Western at Casper, Wyo., has been appointed superintendent of the Northern Iowa division, with office at Eagle Grove, Iowa, succeeding E. E. Smith, assigned to other duties. The Iowa division, in charge of F. H. Hammill, at Boone, Iowa, having been subdivided into the East and West Iowa divisions. W. W. Walliser, division superintendent at Winona, Minn., has been appointed superintendent of the East Iowa division, with office at Belle Plaine, Iowa, and F. H. Hammill continues at Boone, with jurisidiction over the West Iowa division. C. T. Boone, assistant division superintendent at Boone, succeeds Mr. Cantillon at Casper, Wyo., and E. E. Nash succeeds Mr. Walliser at Winona.

John A. Shepherd, whose appointment as general manager of the Western Maryland and the Georges Creek & Cumberland, in charge of the transportation and maintenance departments, with office at Baltimore, Md., has been announced in these columns, was born at Homer, Ill., in 1874, and began railway work in 1893 on the Wabash Railroad, first as an operator and later as train desptcher, and then chief train despatcher. In 1903, Mr. Shepherd went to the Western Maryland as superintendent of transportation and early in the following year left that company to go to the Terminal Railroad Association at St. Louis, Mo., as assistant superintendent in charge of freight movement. He left railway service in 1905 and later in the same year returned to the Western Maryland as superintendent of the Maryland division, which position he held at the time of his recent appointment as general manager of the same company.

C. A. Steiner, superintendent of the West Virginia division of the Western Maryland and the George's Creek & Cumberland at Cumberland, Md., has been appointed superintendent of the Maryland division, except Baltimore terminal, with office at Hagerstown, Md., succeeding J. A. Shepherd, promoted. H. H. Berry succeeds Mr. Steiner. F. L. Brendel, trainmaster of the Western Maryland at Hagerstown, has been appointed superintendent of terminals, with office at Baltimore, Md., with jurisdiction over the Baltimore terminals to and including west switch at Lehigh. George H. Sheets, assistant trainmaster at Hagerstown, has been appointed trainmaster, with jurisdiction over the First district west of Lehigh and the Third and Fourth districts, with office at Hagerstown. E. L. Seigman has been appointed trainmaster, with jurisdiction over the Second, Fifth and Sixth districts, including Hagerstown yard and terminals at Hagerstown. M. Stitzel has been appointed trainmaster, with jurisdiction over Baltimore terminals, at Baltimore, and L. U. Albert has been appointed chief train despatcher at Hagerstown.

Traffic Officers.

G. H. McDevitt has been appointed a commercial agent of the Lehigh Valley, with office at Detroit, Mich.

F. M. Renshaw, contracting freight agent of the Baltimore & Ohio, with office at Cincinnati, Ohio, has resigned to engage in other business.

J. C. Fitzgerald, general freight and passenger agent of the Wisconsin & Michigan, at Chicago, has had his office moved to Menominee, Mich.

J. C. Glenn has been appointed a traveling freight agent of the Minneapolis & St. Louis and the Iowa Central, with office at Minneapolis, Minn.

Joseph B. Morrow, city ticket agent of the Trinity & Brazos Valley at Galveston, Tex., has been appointed soliciting freight and passenger agent, with office at Galveston.

D. T. Lawrence has been appointed general freight agent of the Central Vermont, with office at St. Albans, Vt., succeeding C. E. Dewey, resigned to go to the Grand Trunk Pacific.

H. G. Powell, commercial agent of the Illinois Central at Dubuque, Iowa, has been appointed division freight agent, with office at Omaha, Neb. M. S. Beals succeeds Mr. Powell.

G. E. Stolp has been appointed Oriental freight agent of the Chicago, Milwaukee & St. Paul, with office at Chicago, succeeding T. F. Sweat, Jr., resigned to engage in other business.

W. S. Smith, chief clerk to C. C. Lewis, commercial agent of the St. Louis & San Francisco, at Houston, Tex., has been appointed a traveling freight agent, with office at Houston.

James P. Daly has been appointed general freight and passenger agent of the Ottawa & New York and the New York & Ottawa, with office at Ottawa, Ont., succeeding F. J. Balch, resigned.

A. J. Watts, city passenger agent of the Western Pacific, at Sacramento, Cal., has been appointed a contracting freight agent. Harry Derr, freight agent at Marysville, succeeds Mr. Watts.

A. P. Chapman, Jr., city ticket agent of the Chicago, Milwaukee & St. Paul at Chicago, has been appointed general agent in the passenger department of the Chicago, Milwaukee & Puget Sound, with office at Seattle, Wash.

J. A. Marks, traveling passenger agent of the Chicago, Rock Island & Pacific at Fort Worth, Tex., has been appointed district passenger agent, with office at Houston, Tex. Joseph Gittings, traveling passenger agent at Pittsburgh, Pa., succeeds Mr. Marks. D. G. Goodwill, city passenger agent at Pittsburgh, succeeds Mr. Gittings.

J. F. Govan, district passenger agent of the St. Louis & San Francisco at Cincinnati, Ohio, has been appointed district passenger agent, with office at Houston, Tex. W. S. Merchant, traveling passenger agent at New York City, succeeds Mr. Govan, and E. G. Lamb, traveling passenger agent at St. Louis, Mo., succeeds Mr. Merchant. W. J. Bedford, assistant city ticket agent at St. Louis, succeeds Mr. Lamb.

Harry J. New, traveling passenger agent of the Southern Railway, at St. Louis, Mo., has been appointed a traveling passenger agent, at Kansas City, succeeding William Flannelly, retired. J. R. L. Wulff, traveling freight agent at St. Joseph, Mo., has been transferred to Kansas City, Mo., and the office at St. Joseph has been abolished. J. G. Dryden has been appointed a soliciting freight agent at Kansas City.

J. V. Lanigan, whose appointment as assistant general passenger agent of the Illinois Central and the Indianapolis Southern, with office at Chicago, has been announced in these columns, began railway service 15 years ago, with the Chicago, Burlington & Quincy at St. Louis, Mo. He next went with the Missouri, Kansas & Texas, on which road he held a number of minor positions in the passenger department. In 1906 he went with the Illinois Central, and in 1908 was appointed chief rate clerk in the passenger department, from which office he is now promoted to assistant general passenger agent.

Osborne Scott, whose appointment as assistant general passenger agent of the Canadian Northern, with office at Winnipeg, Man., has been announced in these columns, was born July 6, 1882, at St. Andrews, Man. He was educated at St. John's College and the University of Manitoba, and began railway work in June, 1901, in the office of the auditor of the Canadian Northern, where he remained until February, 1903. He was then transferred to the passenger traffic department, and for three years from September, 1905, was in the general baggage department. He was then for almost two years chief clerk in the general baggage advertising and ticket stock departments. In February, 1910, he was appointed a traveling passenger agent, with office at Toronto, and was appointed chief clerk in the passenger traffic department in September of the same year, which position he held at the time of his recent promotion.

Donald Rose, freight traffic manager of the Illinois Central and the Indianapolis Southern at Chicago, has been appointed European traffic manager, with office in London, England, succeeding J. H. Mallory, general European agent, who has been assigned to duties in the traffic department at Chicago. The jurisdiction of Mr. Rose has been extended also over the Yazoo & Mississippi Valley, the Central of Georgia, and the Ocean Steamship Company of Savannah. D. W. Longstreet, general freight agent at Memphis, Tenn., succeeds Mr. Rose, and V. D. Fort, general freight agent at Chicago, has been appointed an assistant freight traffic manager at Chicago, a new office. J. S. Brown, assistant general freight agent at Chicago, succeeds Mr. Fort; and B. J. Rowe, assistant general freight agent at St. Louis, Mo., has been transferred to Chicago, succeeding Mr. Brown. J. S. Weitzell, assistant general freight agent at Omaha, Neb., succeeds Mr. Rowe. J. Hattendorf, assistant general freight agent at Chicago, has been appointed general freight agent at Memphis, succeeding Mr. Longstreet, and W. E. Downing, assistant general freight agent at Memphis, has been transferred to Louisville, Ky., succeeding William Smith, Jr., general freight agent, transferred to Chicago as assistant general freight agent. William Rhett, general freight agent in charge of export and import traffic at Chicago, has been appointed general foreign agent, with office at Chicago; and C. A. Florence, assistant general freight agent at Chicago, has been appointed assistant general foreign agent.

John W. Daly, assistant passenger traffic manager of the New York Central Lines west to Buffalo, has been appointed passenger traffic manager, with office at Chicago, succeeding Warren J. Lynch, resigned to become vice-president of the American Steel Foundries. Mr. Daly was born June 2, 1868, at Canton, Ill., and began railway work in 1882 as a telegraph operator on the Wabash, St. Louis & Pacific, now part of the Wabash, after which he was consecutively operator on the Santa Fe at Horton, Kan., and then ticket agent for the same road at Burlingame and Augusta, Kan., and at Springer, N. Mex.; chief clerk in the local office at Chicago, and then chief yard clerk for the Wisconsin Central; and chief clerk in the general passenger office of the Jacksonville Southeastern, now part of the Chicago, Peoria & St. Louis. For seven years from May, 1894, he was general passenger and ticket agent of the Jacksonville, Louisville & St. Louis, now part of the Burlington, and in April, 1901, went with the New York Central Lines as southern passenger agent of the Lake Shore & Michigan Southern at Cincinnati, Ohio. In March of the following year he was transferred to Buffalo, N. Y., as general eastern passenger agent. He remained until January, 1907, at Buffalo, having been appointed chief assistant general agent of the Lake Shore and of the Michigan Central in April, 1905. He was then appointed general passenger agent of the Lake Shore with headquarters at Cleveland, Ohio, and was promoted to assistant passenger traffic manager of the New York Central Lines west of Buffalo in February, 1910, from which office he is now advanced to the position of passenger traffic manager as above.

J. W. Daly.

Engineering and Rolling Stock Officers.

E. G. Stradling has been appointed signal engineer of the Chicago, Indianapolis & Louisville, with office at Lafayette, Ind.

F. L. Stone, engineer of track elevation of the Chicago, Burlington & Quincy at Chicago, has resigned to engage in other business.

M. N. Wells, division engineer of the Atchison, Topeka & Santa Fe at Chanute, Kan., has been appointed an assistant engineer, with office at Chanute.

H. M. Curry, general master mechanic of the Northern Pacific lines east of Mandan at St. Paul, Minn., has been appointed mechanical superintendent, with office at St. Paul, succeeding William Moir, retired after having been with the company for almost 30 years. Silas Zwight, master mechanic at Missoula, Mont., succeeds Mr. Curry.

I. D. Thomas, master mechanic at the Altoona (Pa.) machine shops of the Pennsylvania Railroad, has been promoted to superintendent of motive power of the Erie division of the Pennsylvania Railroad and the Northern Central Railway, with office at Williamsport, Pa., succeeding J. T. Wallis, promoted. J. C. Mengel, master mechanic at West Philadelphia, Pa., succeeds Mr. Thomas. J. M. James, master mechanic at Olean, N. Y., succeeds Mr. Mengel. J. M. Henry, master mechanic at Sunbury, Pa., succeeds Mr. James. Eliot Sumner, master mechanic at Baltimore, Md., succeeds Mr. Henry. H. P. Meredith, assistant engineer of motive power in the office of the general superintendent of motive power, at Altoona, Pa., has been appointed master mechanic, with office at Baltimore, Md., suc-

ceeding Mr. Sumner. C. L. McIlvaine, assistant engineer of motive power of the Erie division and the Northern Central Railway, at Williamsport, Pa., succeeds Mr. Meredith. C. D. Barrett, assistant master mechanic, at Wilmington, Del., succeeds Mr. McIlvaine, and B. B. Milner, on special duty in the office of the assistant to general manager, has been appointed assistant master mechanic, with office at Wilmington, succeeding Mr. Barrett. (See item under Operating Officers.)

Purchasing Officers.

A. L. McNeill has been appointed assistant purchasing agent of the Chicago & Alton, and the Toledo, St. Louis & Western, with office at Chicago.

J. E. Mehaney has been appointed general storekeeper of the First district of the Oregon-Washington Railroad & Navigation Company, with office at Portland, Ore.

J. Lowell White has been appointed assistant purchasing agent of the New Orleans, Texas & Mexico, the Beaumont, Sour Lake & Western, the Orange & Northwestern and the St. Louis, Brownsville & Mexico, with office at Houston, Texas.

OBITUARY.

R. S. Ege, assistant auditor of the Union Pacific, with office at Omaha, Neb., died in Omaha, on April 30.

William B. Wood, supervisor of bridges and buildings of the Missouri Pacific, with office at Atchison, Kan., died at that place on April 25.

John A. Hinsey, formerly special agent of the Chicago, Milwaukee & St. Paul, with office at Chicago, died in Los Angeles, Cal., on May 1, as a result of injuries received in a street car accident. Mr. Hinsey became special agent of the St. Paul in 1865 and held that office continuously until his retirement, last December.

Floyd H. Crane, superintendent of dining and sleeping cars of the New York, New Haven & Hartford, died at his home in New York City, April 26, at the age of 59. Mr. Crane had held this position on the New Haven road for about 19 years, and before that was on the Tehuantepec National and the Long Island Railways, and for a time was with the Woodruff Sleeping Car Company. He had extensive real estate interests and was interested in other outside enterprises. He is survived by his wife and a son, L. S. Crane.

F. B. Clarke, former president of the Spokane, Portland & Seattle, and previous to that general traffic manager of the Great Northern, died at Portland, Ore., on April 25. Mr. Clarke was born July 1, 1838, in Madison county, N. Y., and began railway work in 1868 with the Wisconsin Central. He was later general freight agent, and in 1872 was appointed general freight and passenger agent of the same company. In 1878 he went to the Chicago, St. Paul, Minneapolis & Omaha as general traffic manager. From September, 1895, to December, 1896, he was general traffic manager of the Northern Steamship Company, and in December, 1906, was appointed general traffic manager of the Great Northern. Mr. Clarke went to Portland, in January, 1908, to take charge of the Hill interests in that city. He was made president of the Spokane, Portland & Seattle, and was the first operating head of that road. Failing health caused him to retire about two years later.

Hilon A. Parker, formerly vice-president of the Chicago, Rock Island & Pacific, died suddenly from apoplexy at his home in Washington Heights, Chicago, on May 3. Mr. Parker was born December 30, 1841, at Plessis, N. Y., and began railway work in 1866 as chairman on the Chicago, Rock Island & Pacific; and by 1869 had become resident engineer on the southwestern extension of the Rock Island. From 1876 to 1885 he was division engineer of the Illinois division, and in 1885 was elected vice-president and chief engineer of the Chicago, Kansas & Nebraska, and was made general manager also in 1888. He was appointed assistant to the president of the Chicago, Rock Island & Pacific in 1889, and in 1890 was elected third vice-president. On June 1, 1898, he was elected second vice-president, and in March of the following year was made first vice-president and general manager. He left the Rock Island in 1903, and during recent years acted as consulting engineer for the Grand Trunk Pacific.

Railway Construction.

New Incorporations, Surveys, Etc.

Arizona Roads.—The Inspiration Copper Company will build a railway from its property at Globe, Ariz., to Wheatfields, on Pinal creek.

Arkansas City, Wellington & Northwestern.—An officer writes that surveys are now being made from Arkansas City, Kan., northwest via Wellington, Conway Springs and Cheney to Hutchinson, about 95 miles, and it is expected to let contracts soon after the surveys are completed. The prospects for carrying out the work are good. G. H. Hunter, president, Wellington, and Fremont Hill, chief engineer, Wichita. (March 24, p. 710.).

Aroostook Valley (Electric).—The plans of this company call for building 100 miles of new lines, it is said, this coming summer. (April 14, p. 907.)

Bangor & Aroostook.—This company has filed with the Maine Railroad Commission the final survey for the Allegash extension, from West Seboois, Me., north to St. Francis, 157 miles, much of which it is expected will be built this year. The new line will be built through a heavy timber section. (April 14, p. 907.)

Birmingham & Southeastern.—This is the new name of the Union Springs & Northern. The company operates a line from Union Springs, Ala., to Fort Davis, 7.5 miles, and will resume work at an early date on the extension from Fort Davis, northwest to Milstead, about 20 miles.

Canadian Pacific.—An officer is quoted as saying that construction work on the lake shore line between Montreal, Que., and Toronto, Ont., via Smith's Falls and Belleville is to be commenced at once, so the line can be placed in operation within two years. The line as projected will have a 0.4 per cent. grade throughout and will be used exclusively for fast passenger service. Work will begin at both ends in order to expedite construction. The Canadian Pacific's business between Montreal and Toronto is said to be big enough not only to make necessary the construction of the above additional line, but to warrant the double-tracking of same at once.

Central California Traction.—This company will build an extension, it is said, from Lodi, Cal., northwest to Woodbridge, about five miles.

Denver, Enid & Gulf.—According to press reports, a contract has been let to build from Kiowa, Kan., northwest to Dodge City, 125 miles.

El Paso & Southwestern.—This company has filed right-of-way maps showing the route of an extension to be built from Benson, Ariz., northwest to Tucson.

Fort Dodge, Des Moines & Southern.—An officer is quoted as saying that surveys are being made to build an extension from Fort Dodge, Iowa, northwest to Spirit Lake, about 85 miles.

Great Southern.—An officer writes that this company, which operates a 30-mile line from The Dalles, Ore., to a point southwest, at Dufur, is letting contracts for building an extension of 38 miles, from Dufur, in a southwest direction. There will be 10 trestles and one 1,200 ft. tunnel. The line will tap a heavy timber section.—(Apr. 21, p. 970.)

Idaho & Washington Northern.—This company will build a branch, it is said, from Newport, Wash., to Diamond lake, and another branch from Dalkena, south to Davis lake.

Kentucky Midland.—An officer writes regarding the reports that an extension is to be built from Earles, Ky., west to Madisonville, 14 miles, that it has not yet been definitely decided to build this extension.

Long Island.—The improvement work to be carried out during this year will be confined chiefly to sections of the lines into and in Jamaica. A comprehensive reconstruction plan will be followed there, as has already been mentioned in these columns. The work to be done on the North Side division will be confined to grading work and elimination of grade crossings. It will require about one year to put this division, which extends to Port Washington, in shape for electrification. When these improvements are finished work will be started on the Wood-

side—Winfield cut-off. This work will include straightening the present line and the elimination of 16 grade crossings. The electrification of the Oyster Bay division will be taken up later, probably early in 1912, and when this improvement is finished the electrification of the lines to Babylon, Huntington and Farmingdale will be carried out. Work is now actively under way on the Bay Ridge extension, which includes the construction of a cut-off and tunnel to East New York. The elimination of grade crossings on the Atlantic avenue division between Jamaica and the Brooklyn city line, and in Queens borough, will be undertaken after the above improvements have been finished, probably some time in 1916 or 1917. (Sept. 30, p. 599.)

METHOW VALLEY & WASHINGTON NORTHERN.—Plans are being made to build from Winthrop, Wash., southeast to Pateros, 50 miles.

MISSOURI, ARKANSAS & GULF.—An officer writes that the proposed route is from Rolla, Mo., south via Lecoma, Anutt, Lenox, Licking, Raymondville and Willow Springs to Bakersfield, about 125 miles, and the prospects of building the line are good. Gilbert Lay, president, St. Clair. (April 28, p. 1010.)

NASHVILLE-GALLATIN INTERURBAN.—An officer writes that contracts are to be let in a few weeks to build from Nashville, Tenn., northeast via Madison, Goodlettsville and Henderson to Gallatin, 27 miles. The Fidelity Securities Corporation has the general contract. Maximum grades will be 3 per cent., and maximum curvature 6 deg. The grading work will include some rock work, but it is not very difficult. There will be two steel bridges and a 1,000-ft. trestle. H. H. Mayberry, president, and John A. Pitts, vice-president and general counsel, Nashville. (January 20, p. 143.)

NEVADA-CALIFORNIA-OREGON.—In connection with the extension now under construction from Alturas, Cal., north to Lakeview, Ore., the city of Lakeview has been asked to secure a right-of-way into the city from a point eight miles outside of the city, also a site for a station and switching yards outside of the corporate limits of the city. The railway company has agreed to put up a station in Lakeview, to cost $12,000. (April 28, p. 1016.)

OREGON ROADS (Electric).—The Canby Canal Company, Oregon City, Ore., it is understood, will build an electric line from Canby, Ore., southeast to Molalla, with branches to Beaver creek, Meadowbrook, Colton, Needy and Macksburg.

OREGON SHORT LINE.—An officer writes that the company has started preliminary work for building two short branches, one from Caldwell, Idaho, west 11 miles, and the other from Nyssa, easterly to Homedale along the south bank of Snake river, 26 miles. These lines are to be built to accommodate some newly developed irrigated lands.

PACIFIC ELECTRIC.—This company will build an extension, it is said, from Arlington, Cal., near Riverside, west to Corona, about eight miles.

PALACIOS, SAN ANTONIO & PECOS VALLEY.—An officer is quoted as saying that contracts for building the first 36 miles will be let within the next 30 days. The construction work is to be started from Palacios, Texas, west to Francitas, in Jackson county, thence to Edna. About two-thirds of the right-of-way northwest to San Antonio has been secured. The plans call for building a main line, with branches of 160 miles. J. P. Pierce, president, and H. W. Dean, secretary and manager, Palacios. (October 7, p. 672.)

PENNSYLVANIA LINES WEST.—An officer writes that the proposed improvements on the Cleveland & Pittsburgh division to make that a four-track division and to eliminate the grade crossings in Cleveland, are only contemplated. The work has not yet been authorized.

PENNSYLVANIA RAILROAD.—Governor Wilson, of New Jersey, has signed the Leavitt measure, which will permit the Pennsylvania Railroad to acquire by purchase or condemnation land for two additional tracks between Trenton, N. J. and Jersey City. The company has four tracks at present, and the additional facilities are deemed necessary to relieve the congestion of the New York division due to the heavy suburban traffic.

PITTSBURG & SHAWMUT.—An officer writes that it is expected to have work finished in September of this year on the section from Knoxdale, Pa., south along Mahoning creek to Mahoning, thence over the Allegheny river and along the west bank to Freeport. The work is very heavy and includes five tunnels; four viaducts, one 1,500 ft. long and 125 ft. high, another 1,500 ft. long and 150 ft. high, and two viaducts, each 600 ft. long and 125 ft. high, also a bridge over the Allegheny river at Mahoning, about 1,200 ft. long. Track has been laid on 10 miles. James Corbett, Kitanning, is the contractor.

SIOUX FALLS & SOUTHERN MINNESOTA TRACTION.—Incorporation has been asked for by this company in South Dakota, with $300,000 capital, and office at Pierre, S. D. The plans call for a line from Sioux Falls, S. D., east via Worthington, Minn., Sioux Valley, Loon Lake, Petersburg, Dunnell, Coylon and Pilotgrove to Albert Lea, about 175 miles. The incorporators include: L. B. Wyckoff, Syracuse, N. Y.; C. S. Sollars, H. W. Knight and J. J. Danforth, Chicago, and G. P. Peterson, Pierre, S. D.

SOUTHERN PACIFIC.—An officer is quoted as saying that double-tracking work on the Southern Pacific and the Union Pacific aggregating about 300 miles, has been authorized for completion this year. On the Southern Pacific the work will be principally on the section near Ogden, Utah, and Sacramento, Cal. On the Union Pacific 150 miles will be added to the double-track between Omaha, Neb., and Ogden, Utah, and a small section will be double tracked in Wyoming.

TEXAS, OKLAHOMA & EASTERN.—This company, which was incorporated last year in Oklahoma with $200,000 capital, has work under way on four miles and track already finished on 19 miles. The plans call for building from Valliant, Okla., through McCurtain county, east through a timber section, via Bismark, to Mountain Fork river, 30 miles, and it is understood the line will eventually be extended into Arkansas. H. Dierks, president and general manager, and H. L. Dierks, secretary, both of Kansas City, Mo. (October 28, p. 813.)

TIDEWATER & SOUTHERN (Electric).—This company has been granted a 43-year franchise at Modesto, Cal., to which place the line is now being built from Stockton. The rights include an entrance into Modesto and maintenance of tracks on Ninth street. (April 28, p. 1016.)

UNION PACIFIC.—See Southern Pacific.

UNION SPRINGS & NORTHERN.—See Birmingham & Southeastern.

WASHINGTON ROADS.—Application has been made by Paul L. Richards, Ellensburg, Wash., to the county commissioners for a franchise to build an electric line in Kittitas county.

FOREIGN RAILWAY NOTES.

The Swiss Federal Railways have approved a project for the construction of a new line, slightly over eight miles in length, from Moutier, under the Jura mountains, to Lengnau, a station about midway on the line between Solothurn and Bienne. The proposed line, the object of which is to pierce the Jura mountains, is to leave Moutier, 1,730 ft. above the sea, and is to run for a great part of its course under the Grenchenberg by means of a tunnel, which will be over four miles long, or about half of the total length of the line. The highest point to be attained will be about 1,787 ft. above the sea level. No unusual difficulties are expected, but it is probable that a large amount of water will be encountered. The tunnel will take about four years to complete.

There are at present 142 railways in Germany, owned or operated by private companies. Of these, 60 are in Prussia, 14 in Baden, 11 in Bavaria, 10 in Wurtemberg, eight each in Alsace-Lorraine and Brunswick, five in Schwarzberg-Sondershausen, four in Saxony, three each in the Grand Duchies of Hesse, Sachsen-Koburg and Anhalt, two each in Mecklenburg-Schwerin, Mecklenburg-Strelitz, Schwarzburg-Rudolstadt and Lubeck, and one in Oldenburg, Sachsen-Altenburg and Russ. Most of these are, of course, small local lines, and the Lenz Railway Building & Operating Co., Berlin, alone operates over 50 short local railways in various parts of the country. The best-known private line is perhaps the Lubeck-Buchen Railway, which is a little less than 100 miles long.

Railway Financial News.

Arkansas, Oklahoma & Western.—See Kansas City & Memphis.

Atlantic Coast Line.—J. P. Morgan & Co., New York, have bought $3,000,000 unified 4 per cent. bonds, due 1959.

Atlantic Northern & Southern.—A press despatch from Atlantic, Iowa, says that a receiver is to be appointed. This road runs from Kimballton, Iowa, to Atlantic, 17 miles.

Carolina, Clinchfield & Ohio.—The *Wall Street Journal* says: "Officers of the Chesapeake & Ohio and the C. C. & O. are figuring on a lease of the C. C. & O. to the Chesapeake & Ohio. * * * Under the proposed terms the construction of a line from Dante to Elkhorn City (between 40 and 50 miles), which will connect the two roads, will be paid for with funds raised by the Clinchfield on securities bearing the Chesapeake & Ohio's guarantee.

Chesapeake & Ohio.—Eastman, Dillon & Co., New York, have prepared a little booklet giving a brief review of the Chesapeake & Ohio's past history and an analysis of its present and future earning possibilities. Besides the usual analysis made from the figures published in reports of the company, there are included some estimates of the coal tributary to the Chesapeake & Ohio's lines.

See also Carolina, Clinchfield & Ohio.

Chicago & North Western.—Kuhn, Loeb & Co., New York, have bought $7,500,000 general mortgage 4 per cent. bonds. The proceeds of the sale of these bonds will be used by the railway company for the completion of a line which will form a direct route from Milwaukee, Wis. to Wyeville, where the road connects with the Chicago, St. Paul, Minneapolis & Omaha.

Havana Central.—The stockholders of the United Railways of the Havana & Regla Warehouses Co. have authorized an increase in the capital stock of that company of $10,000,000, of which part is to be used to pay for $2,500,000 Havana Central notes.

Illinois Tunnel.—James B. Colgate & Co., Chicago, have bought the remaining $500,000 of the authorized issue of $3,500,000 6 per cent. receivers' certificates and have resold these securities at 100⅛.

Kansas City & Memphis.—This company on May 1 took over the Arkansas, Oklahoma & Western and the Monte Ne.

Kansas City, Mexico & Orient.—The engineer of the Texas Railway Commission has placed a value of $519,000 on that part of the Kansas City, Mexico & Orient running from San Angelo to Mertzon, 30 miles. The company, it is understood, will issue $491,000 bonds secured on this part of the road and $28,000 stock.

Michigan United Railways.—This company has leased the Kalamazoo, Lake Shore & Chicago for five years. The K. L. S. & C. runs from Kalamazoo, Mich. to South Haven, 54 miles, and during the summer only from South Haven to Paw Paw, 17 miles. It is planned to equip the road for operation by electricity.

Missouri Pacific.—James Speyer, recently elected a director, has been elected a member of the executive committee, succeeding Cornelius Vanderbilt, resigned.

Monte Ne.—See Kansas City & Memphis.

National Railways of Mexico.—Ladenburg, Thalmann & Co., Speyer & Co., Kuhn-Loeb & Co. and Hallgarten & Co., all of New York, have bought $10,000,000 two-year 4½ per cent. notes, secured by the deposit of prior lien and general mortgage bonds. The proceeds of the sale of these notes is to be used by the railway company to retire $3,661,000 Mexican Central consolidated mortgage 4 per cent. bonds, due July 1 and the balance is to be used for new equipment and improvements.

New York, New Haven & Hartford.—It is announced that Edward Milligan, of Hartford, Conn., and Francis T. Maxwell, of Rockville, Conn., are to be elected directors to succeed A. S. May and A. E. Clark.

Northern Central.—See Pennsylvania Railroad.

Oregon Short Line.—This company has made a mortgage to secure $150,000,000 first and consolidated mortgage bonds, dated December 1, 1910, to bear interest not to exceed 5 per cent. and due 1960. Series A, which includes $24,000,000 bonds, now issuable, are subject to call after December 1, 1915, at 105. The mortgage is on about 1,688 miles of line, of which 1,512 miles are in operation and 176 miles are now under construction, and of which about 594 miles are free from any prior mortgage lien. Of the total bonds, $24,000,000, as mentioned above, may be issued at once to reimburse the company for the cost of acquisition of lines already paid for, and $34,422,000 bonds are reserved to retire a like amount of underlying bonds held by the public, and $91,578,000 bonds are reserved to pay for additional lines and for double-tracking and for additions and betterments, including improvements of tunnels, trestles and bridges, ballasting, reduction of grades, and for additional rolling stock, etc.

Pennsylvania Railroad.—The Public Service Commission of Maryland has approved the proposed lease of the Northern Central to the Pennsylvania Railroad and has authorized the issue of $7,735,050 Northern Central stock as a 40 per cent. stock dividend.

Pittsburgh, Cincinnati, Chicago & St. Louis.—This company has sold to Kuhn, Loeb & Co., New York, $3,000,000 consolidated mortgage 4 per cent. bonds. These bonds are part of an authorized issue of $75,000,000, of which about $50,000,000 are outstanding.

Seaboard Air Line.—The bankers who recently bought $19,000,000 refunding mortgage 4 per cent. bonds, are to exercise the option which they have on an additional $4,000,000 bonds. The company will use the proceeds from the sale of the additional bonds for improvements and for additional working capital, and President Meldrum is quoted as saying that no more financing will be necessary for the remainder of the year.

St. Louis & San Francisco.—This company has leased the Louisiana Southern, which operates about 40 miles of line.

Western Maryland.—E. D. Adams, representing the Deutsche Bank of Berlin, has been elected a director of the Western Maryland, succeeding B. F. Bush, resigned. Mr. Adams is the representative of the Deutsche Bank interests on the board of directors of the Missouri Pacific.

FOREIGN RAILWAY NOTES.

A new railway line opening up a dormant part of Poland began operations in March. This line will stimulate the economic and industrial conditions even in the most remote parts. Its line is 83 miles long and runs from Herby, on the borders of German Silesia, to Kielce, the capital of the province of that name, via Czenstochova, thus cutting through the southern part of the province of Piotrkov and the northern part of the province of Kielce. The other principal stations are Ostrowy, Gwarzyn, Czenstochova, Hantke, Olsztyn, Sloty Potok, Koniecpol, Zelislawice Wloszczowa, Ludynja, Malogoszcza, and Piekoszow. From Ostrowy there is a 1-mile branch to a large iron factory at Blachownia and from Hantke another 1-mile branch runs to the smelters at Rakow.

Belgian State Railways Administration has decided to make an important improvement in the Franco-Dutch services via Brussels, by building a direct line connecting the Nord and Midi stations at Brussels. This will do away with the present circuitous route through the outskirts of the city over which the international expresses travel. The most important part of the scheme is the construction of a new central passenger station, a project that has been under discussion for some years. This central station will be situated between the Nord and Midi stations and will be the most important passenger station in Brussels. Most of the new line will be in tunnel, and electric traction will be employed. The central station and connecting line are to be opened by 1915 and the entire cost, including subsidiary works and electric locomotives, is estimated at $16,000,000.

Supply Trade Section.

The Andreson-Evans Company, Chicago, has moved its general offices from the Monadnock block to the Railway Exchange.

The Detroit Steel Products Company, Detroit, Mich., on May 1 moved its New York offices from 2 Rector street to 225 Fifth avenue.

The Sprague Electric Company, New York, has moved its Boston office from the Weld building to 201 Devonshire street, where larger floor space has been obtained.

The forge shops, the machine shop and one of the iron foundries of the Canadian Car & Foundry Company, Montreal, Quebec, at Amherst, N. S., were destroyed by fire on April 27.

The Pittsburgh Testing Laboratory, Pittsburgh, Pa., has moved into its new five-story office and laboratory building at the corner of Seventh avenue and Bedford avenue. This plant is said to be the largest of its kind in the country.

George A. Blackmore has been appointed eastern manager of the Union Switch & Signal Company, Swissvale, Pa., with office in New York, and Aaron Dean has been appointed western manager, with office in Chicago. Both appointments will be effective May 15.

The American Journal Bearing Company, Portland, Me., has recently been incorporated to make bearings for locomotives, cars and machinery. The authorized stock issue is $250,000. The officers of the company are as follows: President, Clarence E. Eaton; treasurer, Albert F. Jones; clerk, James E. Manter; all of Portland.

F. L. Stone, engineer of track elevation of the Chicago, Burlington & Quincy at Chicago, has resigned to go with Mrs. W. B. Ewing and Edwin Hancock, to continue the business of the late W. B. Ewing, civil and consulting engineer, specializing in civil, sanitary and municipal work, with office in the Monadnock block, Chicago.

John Reis has been appointed vice-president of the United States Steel Corporation; and Ward B. Perley has been made assistant to the president, James A. Farrell. Mr. Perley was assistant to W. B. Dickson, who recently resigned as a vice-president. Mr. Reis has been and will continue to be in charge of the construction.

The Haskell & Barker Car Company, Michigan City, Ind., has acquired five city blocks adjacent to its shops and will build a plant for the manufacture of steel freight cars, steel front-end passenger train cars, cast steel trucks, etc. The plant will cost $1,500,000, or more. At present the company makes only wooden and steel-underframe cars.

The Kerite Insulated Wire & Cable Company, New York, has acquired the interests of its western representative, the Watson Insulated Wire Company, Chicago, and has opened a branch office in the People's Gas building, Chicago. E. L. Winchell, Jr., vice-president of the Watson Insulated Wire Company, has been made western sales manager of the Kerite company.

The Grand Trunk has specified Bohn syphon refrigerators, made by the White Enamel Refrigerator Company, St. Paul, Minn., for its special refrigerator equipment in the new $1,000,000 Hotel Chateau Laurier and Central Union station at Ottawa, Canada. The equipment consists of 44 specially built refrigerators of various sizes equipped with the Bohn system.

The Milwaukee Refrigerator Transit Company and the Milwaukee Car Manufacturing Company, makers of refrigerator and other freight cars, have been consolidated and the name changed to the Milwaukee Refrigerator Transit & Car Company, Milwaukee, Wis. The officers are as follows: President, Fred Papst; vice-president, Robert Nunnemacher; secretary and general manager, H. W. Marsh. The company intends to make extensive improvements, but probably not before the railway situation shows improvement.

The railway supply men for the International Railway General Foremen's Association, will give an exhibit in connection with the sixth annual convention of this association, which will be held at the Sherman Hotel, Chicago, July 25 to 27. The exhibit will be on the floor where the meeting will be held and the fee of $25 for representation will entitle an exhibitor to one representative and 5 ft. of front exhibit space. Additional space may be had if desired. Applications for space should be addressed to J. C. Younglove, secretary and treasurer, 322 North Michigan avenue, Chicago. Space will be assigned by the executive committee in the order in which applications are received.

Explaining the deal concerning the Baldwin Locomotive Works, Philadelphia, Pa., which has been arranged except as to details, Alba B. Johnson, vice-president, issued this statement on May 3:

"At a meeting of the directors and stockholders of the Baldwin Locomotive Works, held today, it was decided to reconstruct the present close corporation in such a way as to admit new interests into our company. No change, however, in policy or management is contemplated. This business has long been one of the standard industries of Philadelphia and the same principles of management which have built up the property to its present proportions and have always yielded adequate profits to the owners will continue to prevail. Drexel & Co., of Philadelphia, and White, Weld & Co., of New York City, will act as bankers in connection with this matter."

Alexander E. Brown, president of the Brown Hoisting Machinery Company, Cleveland, Ohio, died at his home in Cleveland, April 26, of apoplexy. Mr. Brown was a mechanical and civil engineer, as well as an inventor. He was born on May 14, 1852, in Cleveland. In 1869 he entered the Brooklyn Polytechnic Institute at Brooklyn, N. Y., from which he was graduated in the engineering course in 1872. For several months Mr. Brown was in the employ of the United States Geological Survey. During the next two years he served as chief engineer of the Massillon Iron Bridge Company, Massillon, Ohio, where he obtained his first real experience in the iron business. From 1875 to 1878 he designed, built and contracted for the sale of bridges and buildings. He later acted as superintendent at iron mines in the Lake Superior iron region and became familiar with blast furnace work. In 1875 he designed and patented new machines and processes for annealing malleable iron castings. In 1878 he became a mechanical engineer for the Cleveland Electric & Supply Company. He developed while with this concern the process and method of manufacturing light carbons. Still later he worked with Charles F. Brush, of the Brush Electric Company, London, England, in developing and placing on the market the Brush arc-lighting system. It was in 1879 that he took up the problem of the rapid and economical unloading and handling of iron ore from boats. A year later he took out patents on the Brown hoisting and conveying machines on the dock of the New York, Pennsylvania & Ohio, now the Erie. Then he organized the Brown Hoisting & Conveying Machine Company for the manufacture of his machines. The name of this company was changed a few years ago to the Brown Hoisting Machinery Company. He was president and general manager of this concern. For the past 30 years he had spent most of his time designing and manufacturing machinery for the handling of different materials. Several hundred patents were granted to him in this and other countries. Mr. Brown also took an active interest in the development of trade schools in Cleveland. He was

Alexander E. Brown.

a member of the American Institute of Mechanical Engineers, the American Institute of Mining Engineers, the Civil Engineers' Club, the Electrical Engineers' Club, the Union Club and the Country Club of Cleveland, the Engineers' Club of New York and the Chamber of Commerce of Cleveland.

The Universal Vanadium Company, New York, has recently been incorporated in Delaware. The officers are as follows: President, Edward M. McIlvain, 30 Church street, New York; vice-president, Col. Millard Hunsicker, 23 Rue de la Paix, Paris, France; secretary and treasurer, James C. Gray, Frick building, Pittsburgh, Pa. Hitherto the entire product of vanadium alloys produced by the American Vanadium Company, Pittsburgh, has been marketed by the Vanadium Sales Company of America, Pittsburgh. The Universal Vanadium Company was formed to act as selling agent for the American Vanadium Company in a more comprehensive and effective manner, and it will act in a selling capacity in conjunction with the Vanadium Sales Company of America; both companies together taking charge of the entire product of the American Vanadium Company.

TRADE PUBLICATIONS.

Central Vermont.—This company has published a small booklet on summer homes in the green hills of Vermont, giving full information on the summer resorts on Lake Champlain and in Canada, reached by the lines of the Central Vermont.

Pressure Blowers and Exhaust Fans.—The American Blower Company, Detroit, Mich., has published a series of bulletins, illustrating and describing its pressure blowers and exhaust fans. These bulletins include diagrams and tables and give full information on the products. Bulletin 291 is devoted to disc ventilating fans, bulletin 292 to cooling tower fans, bulletin 293 to pressure blowers, bulletin 294 to cast iron volume blowers, bulletin 298 to steel plate exhaust fans and bulletin 299 to cast iron exhaust fans.

RAILWAY STRUCTURES.

Big Timber, Mont.—The Northern Pacific will build a freight depot. Thomas Brady, St. Paul, Minn., is general contractor.

Bonners Ferry, Idaho.—The Great Northern will build a bridge over the Kootenay river, at Bonners Ferry, to cost $30,000.

Boone, Iowa.—The Chicago & North Western will build a one-story, 35-stall roundhouse of brick and steel construction. Charles W. Gindele is general contractor.

Brookfield, Mo.—The Chicago, Burlington & Quincy will build a one-story, 41-stall, brick and steel roundhouse and water station.

Decoursey, Ky.—The Louisville & Nashville has let a contract for building a freight yard with double hump switching system to have a capacity of 4,000 cars a day.

Delavan, Wis.—The Chicago, Milwaukee & St. Paul will build a passenger station.

Dillon, S. C.—The North & South Carolina will build a freight depot.

Goshen, Cal.—The Southern Pacific is enlarging the station at Goshen.

Grand Rapids, Mich.—The Pere Marquette will build a $75,000 roundhouse.

Grants Pass, Ore.—The Grants Pass & Rogue River, it is said, will build a steel bridge, 775 ft. long, over the Rogue river, at Grants Pass. It is expected to have the work finished by August 1.

Kenova, W. Va.—An officer of the Norfolk & Western writes that the bridge over the Ohio river was originally designed to carry double tracks. The tracks over the structure are now gauntleted and operated as double-track. The company plans to make such improvements as are necessary to provide for full two tracks over the structure.

Lincoln, Neb.—The Chicago, Burlington & Quincy will build a brick passenger station.

Mahoning, Pa.—See Pittsburg & Shawmut under Railway Construction.

Marshall Texas.—The Texas & Pacific has plans made for a $25,000 passenger station, and will begin its erection as soon as the appropriation has been made

Napavine, Wash.—The Northern Pacific has commenced work on improvements to the station at Napavine.

Newman, Ga.—The Atlanta & West Point will build a $30,000 passenger station.

New Westminster, B. C.—The British Columbia Electric will build a new station, it is said, at New Westminster to cost $30,000.

Oscilla, Ga.—The Atlanta, Birmingham & Atlantic, the Seaboard Air Line and the Oscilla Southern have plans for the erection of a brick veneer passenger station.

Pickens, S. C.—The Pickens Railroad has begun construction of a freight and passenger station.

Portland, Ore.—The Southern Pacific has taken out a permit to build a new warehouse at Portland, to cost $40,000.

Redlands, Cal.—The Southern Pacific will make extensive improvements, it is said, to the station at Redlands.

Ridgeville, Ind.—The Pennsylvania will build a two-story brick and plaster passenger station.

Utica, N. Y.—The Delaware, Lackawanna & Western will build a one story, brick freight house, 30 ft. x 300 ft., to cost $25,000.

Waterman, Texas.—The Gulf, Colorado & Santa Fe will build a passenger station.

Yardley, Pa.—An officer of the Philadelphia & Reading writes that a contract has been given to the F. M. Talbot Co., New York, for putting up a concrete arch over the Delaware river at Yardley. There will be 12 spans, each 90 ft. 9 in. long, and two spans, each 83 ft. 6 in. long. The greatest height of the structure will be 75 ft.

Railway Liabilities in France.

Owing to recent severe floods of the Seine, France, transportation by means of barges became impossible, and quantities of goods which ordinarily would have reached Paris by water had to be sent by rail, thus encumbering the freight stations and creating a demand for extra trains, which the state railways were unable to supply. The administration of the state railways has refused to consider itself responsible for any delay or loss of goods intrusted to it for transit, and has introduced the plea of "force majeure" (circumstances beyond its control) to combat all claims for damages. In order to decide the question five test cases were brought on March 22, 1911, and the commercial tribunal decided in favor of the plaintiffs, who were senders of merchandise that was either lost in transit or greatly delayed in delivery. The chief reasons on which the commercial tribunal based its decision were the following: (1) In order that the plea of force majeure may be invoked it must be a complete obstacle to the carrying out of an obligation undertaken by the defendants. In this case the obstacle to the transportation of goods was not due to any cause foreign to the defendants or independent of their good will, but to bad organization and lack of railway material. (2) The courts have already decided that force majeure, by virtue of which contracts can be canceled, must be caused by an event which could not have been foreseen, and whose effects could not be successfully dealt with. (3) The state railway had been taken over from the old company by the government to better the service and material, and the latter had had plenty of time to carry out improvements, as they have the public funds at their disposal. (4) The real cause of delay was the state's own fault and not any obstacle. (5) The line was evidently in good condition and open to traffic, as proved by the fact that special services and trains were arranged for certain traders. (6) It is impossible to invoke the plea of force majeure in certain cases when good delivery had been made in certain others during the same period.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Pennsylvania will build 77 locomotives at its Altoona shops.

W. R. Grace & Co., New York, has ordered 1 locomotive from the H. K. Porter Company.

The Laurinburg & Southern has ordered one ten-wheel locomotive from the Baldwin Locomotive Works. The dimensions of the cylinders will be 18 in. x 26 in.

The Missouri, Kansas & Texas has ordered 9 switching locomotives from the Baldwin Locomotive Works, and 7 Pacific type locomotives from the American Locomotive Company.

The Norfolk & Western will build 12 mikado locomotives at the company's shops. The dimensions of the cylinders will be 24 in. x 30 in., and the diameter of the driving wheels will be 56 in.

The Seaboard Air Line is said to have ordered 10 consolidation locomotives and 5 switching locomotives from the Baldwin Locomotive Works, and 10 Pacific type locomotives from the American Locomotive Company. This item is not confirmed.

The Baltimore & Ohio has ordered 10 six-wheel switching locomotives from the Baldwin Locomotive Works. The dimensions of the cylinders will be 21 in. x 26 in., the diameter of the driving wheels will be 52 in., and the total weight in working order will be 165,000 lbs.

The Chicago & North Western, mentioned in the *Railway Age Gazette* of April 21 as having ordered 30 locomotives from the American Locomotive Company, ordered 32 locomotives from that company at that time. Of this order 12 locomotives were for the Chicago, St. Paul and Minneapolis & Omaha.

CAR BUILDING.

The Pennsylvania will build 81 steel cars at its Altoona shops.

The Pere Marquette has ordered 12 coaches and 2 combination cars from the Pullman Company.

The Northern Texas Traction Co., Ft. Worth, Tex., has ordered 4 interurban passenger cars.

The Houston Electric, Houston, Tex., has ordered 10 single trailer cars and 5 single motor cars.

The Indianapolis, Crawfordsville & Western, Indianapolis, Ind., has ordered 4 trailing interurban cars.

The Western Maryland has ordered 500 fifty-ton all-steel hopper cars from the Standard Steel Car Company.

The Seaboard Air Line, mentioned in the *Railway Age Gazette* of April 7 as being in the market for 1,000 box cars, 200 phosphate cars and 30 caboose cars, has ordered this equipment from the Pressed Steel Car Company. The box cars will have steel underframes and steel upperframes, they will be ventilated and will have a capacity of 30 tons. The phosphate cars will have a capacity of 50 tons. This company has also ordered 3 passenger and baggage cars, 3 postal cars and 3 express cars from the Pullman Company.

IRON AND STEEL.

The Chicago, St. Paul, Minneapolis & Omaha is said to have ordered 3,000 tons of rails.

The Baltimore & Ohio is in the market for 1,600 tons of structural steel for bridges.

The Florida East Coast has ordered 14,000 tons of rails from the Maryland Steel Company.

The Philadelphia & Reading has ordered 5,000 tons of rails from the Carnegie Steel Company.

The Chicago & North Western is making inquiries for 8,000 tons of structural steel for bridges.

The Duluth, South Shore & Atlantic has ordered 5,000 tons of rails from the Illinois Steel Company.

The Louisville & Nashville is said to have ordered 14,000 tons of rails from the Pennsylvania Steel Company.

The Canadian Northern has ordered 105,000 tons of rails. The Dominion Iron & Steel Company will furnish part of this order.

The Seaboard Air Line has ordered 15,000 tons of rails from the Pennsylvania Steel Company and the Tennessee Coal, Iron & Railroad Company.

General Conditions in Steel.—The steel industry showed a marked improvement toward the end of last week, but the change came too late to have much effect on the reports for the month. The average of daily orders of the Steel Corporation for April was about 25,000 tons, as compared with approximately 35,000 tons in March. The unfilled tonnage of the Steel Corporation for April is expected to show a shrinkage of about 150,000 tons. The railways are beginning to place heavier orders and some large structural orders for other purposes are pending, so the present improvement is expected to continue.

SIGNALING.

The Illinois Traction System, which has been installing automatic block signals extensively during the past six months, has just given the Union Switch & Signal Company an additional order for 37 style B semaphore signals, 12 of them to be used on curves between Princeton and Ottawa, and 25 for a continuous automatic block system between Edwardsville and Granite City.

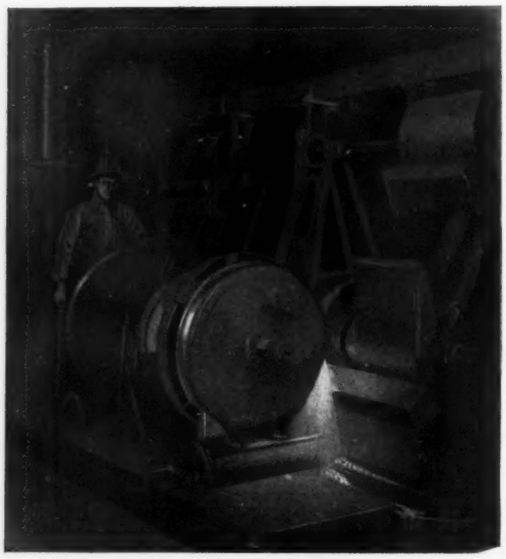
Cast Steel Wheels for Heavy Service.

The excellent results given by cast iron wheels under 30 and 40-ton cars is generally acknowledged, but with the advent of the 50-ton car it has been realized that a stronger wheel is necessary. The first demand was met by the use of the steel-tired wheel, which in England and some other European countries is in universal use. These wheels have also been used for passenger equipment in this country, but have never become common in freight service on account of their high cost. With the realization that a wheel with the strength of the steel-tired wheel would be needed in freight service, the American Steel Foundries, New York, have developed the Davis cast steel wheel, the aim being to produce a wheel of moderate price which would give the longest possible service and cost the least to maintain.

This wheel was the invention of J. C. Davis, assistant to the first vice-president of the American Steel Foundries. By the study of broken flanges on cast iron wheels it was determined from a chemical and metallurgical examination that an excessive amount of sulphur was found at the point of failure. This is a condition which under certain circumstances might occur in one or more of any lot of wheels, and would rather exclude this type of wheel from service under the heavy freight cars now used. Many experiments were made with a blank gear pattern, to see how hard a wheel could be produced in cast steel, which

Annealling Ovens for Davis Cast Steel Wheels.

would have the wearing qualities of the chilled cast iron wheel. It was found that by adding ferro-manganese to the molten steel at the time it was being poured, a casting of any degree of hardness could be made. However, the real problem was to get the desired hardness in the flange and tread, leaving the center soft enough to be machined. It was found that by revolving the mold at the time it was being filled, and introducing

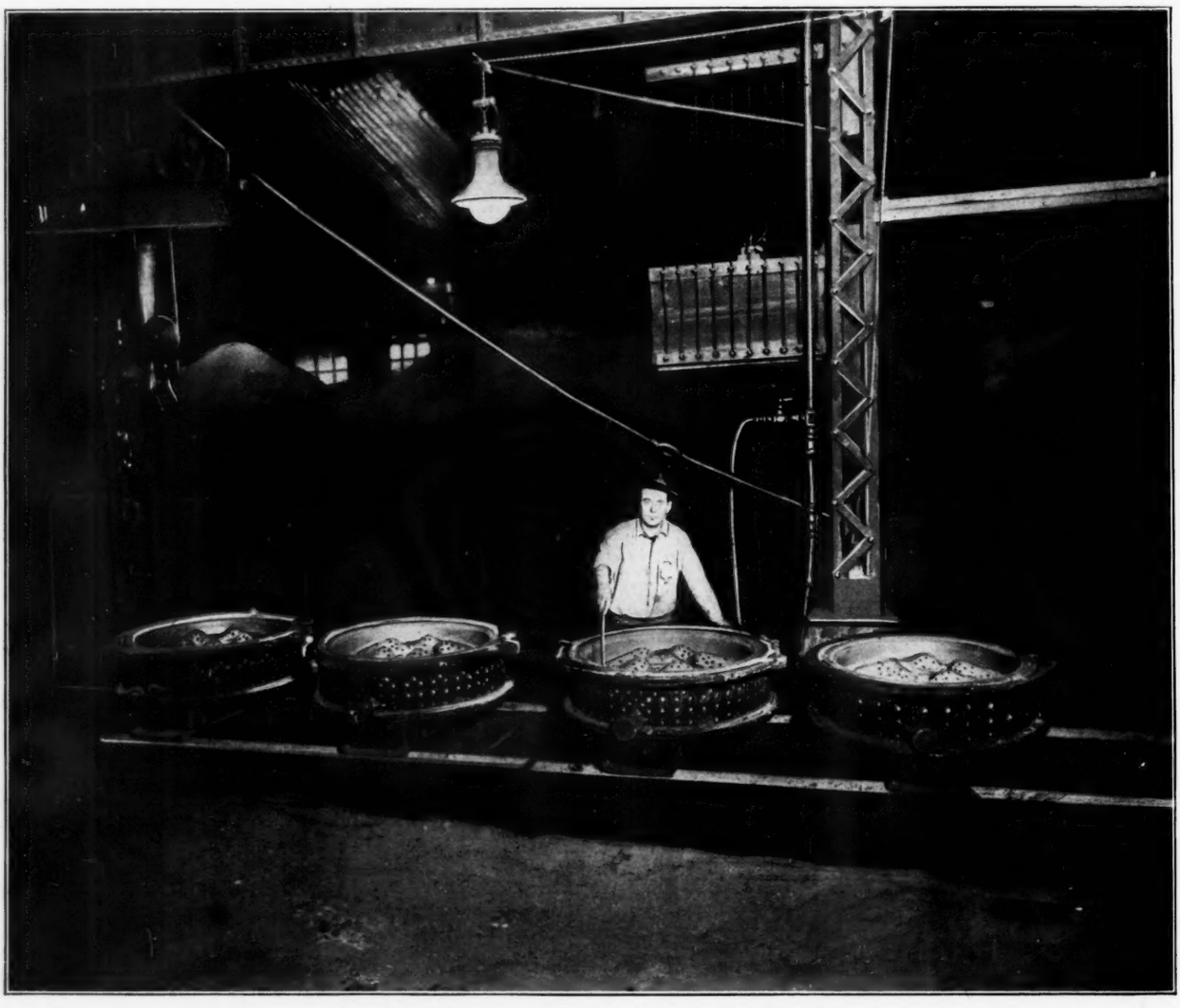


Grinding Cast Steel Wheels.

the ferro-manganese in a certain way, the desired results could be obtained. With the information thus acquired, special apparatus and molds suitable for full-sized wheels were rigged up and the experiments continued on a more elaborate and scientific scale until, from a large number of tests, a standard has been developed for each step in the process. The data obtained at the foundry was further enlarged by results obtained from test wheels put into actual service on various railways where the largest mileage could be obtained in the shortest possible space of time. Some of the early wheels made remarkable mileages, and their records were of great assistance in the standardization of the various operations employed in the manufacture of the wheel.

As carried on by the American Steel Foundries, at their Granite City plant, the manufacture of Davis cast steel wheels has been reduced to an exact science. Rules and formulas have been developed for every step in the process, which, with the instruments used for determining and controlling temperatures, secure a uniformity of results obtainable in no other way. The molds for the wheels are prepared from selected materials and are dried in ovens under the regulation of special pyrometers. When ready for filling they are mounted on tables which revolve during the casting period. The first metal to enter the mold is treated with ferro-manganese in its passage from the ladle to the mold and is followed up, without interruption, by the soft steel which forms the plate and hub of the wheel. The manganese, being heavier than steel, is thrown to the outer parts of the mold by centrifugal force, where it is absorbed in the steel. As manganese steel is one of the hardest and toughest metals known, and has great ability to resist shocks and blows, it is an ideal material for the wearing surface of the wheel.

On being removed from the molds, the wheels are carefully annealed in ovens, in which accurate heat treatment is provided by pyrometer regulation. The object of this treatment is to establish a fine molecular structure, and to eliminate internal strains, which may have been set up during the cooling of the metal after having been cast. From the annealling furnaces the wheels are taken to hydraulic straightening presses, then to bor-



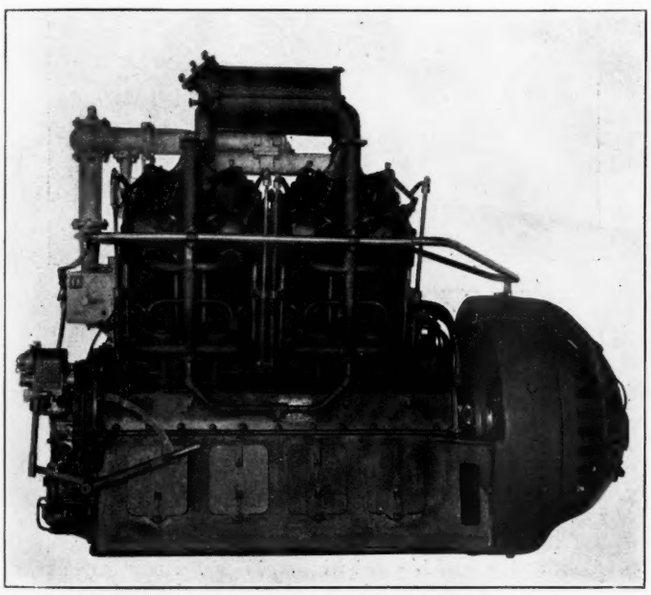
Preparing Molds for Davis Cast Steel Wheels.

ing mills where the wheel fits are rough bored to within ⅛ in. of the finished size, and next to grinding machines, where the tread and throat of the flange are ground. These latter machines are of special construction, being arranged for grinding two wheels at the same time. The wheels are ground not only to make them true, but to give them a polished surface and a general accuracy which reduces the chances of uneven wear after they go into service. After being ground the wheels are again heated and water-toughened, which increases the density of the metal at the rim, at the same time imparting to it that peculiar toughness which is characteristic of good manganese steel.

When the full mileage has been made the wheel may be applied on the purchase of a new one at scrap value. With a multiple mileage wheel there is a temporary loss from service when the wheel is in the shop being trued up, also a loss due to the cost of handling, turning, and the permanent loss in mileage on account of the metal turned off. There are also some advantages over a multiple mileage wheel in the maintenance of standard car and coupler heights on account of there being but slight variation in diameter of the Davis wheel during its life. The standard 33-in. wheel, recommended for heavy freight and tender service, weighs 600 lbs., or about 1,000 lbs. per car less than cast iron wheels, and from 1,200 to 1,600 lbs. per car less than multiple mileage steel wheels.

Gas-Electric Car for Buffalo, Rochester & Pittsburgh.

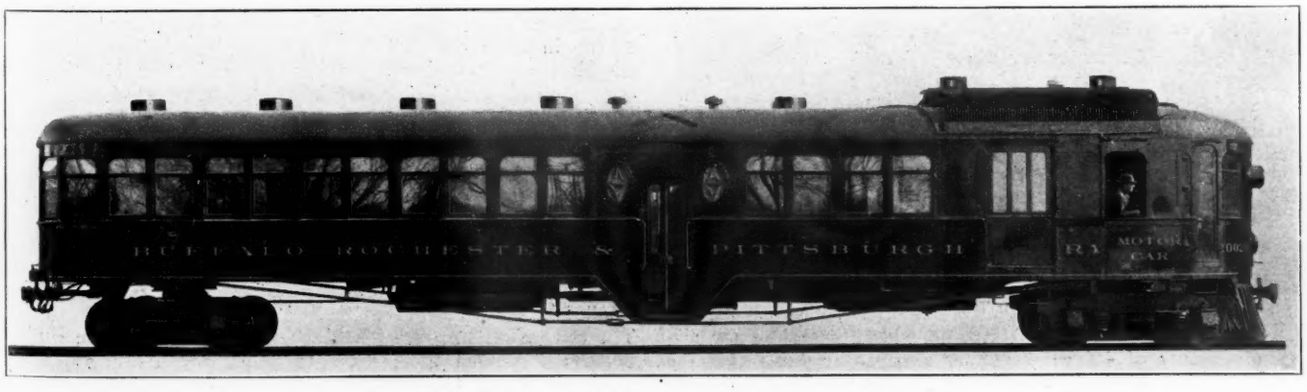
A gas-electric car recently built by the General Electric Company, Schenectady, N. Y., for the Buffalo, Rochester & Pittsburgh is shown in the accompanying illustrations. The car is 66 ft. long, 14 ft. 1 in. high and has a seating capacity for 49 passengers in the passenger compartment and 20 in the smoking compartment, with two persons per seat. However, the seats are sufficiently wide to accommodate 3 persons, which would give a capacity of 69 and 28 respectively. The car derives its power from a gasolene engine and transmits it to the wheels by means of an electric drive, thus avoiding any direct mechanical gearing or connection between the engine and the wheels. The engine is direct coupled to an electric generator, forming a compact power plant located in the engine compartment. The electric power thus generated is applied to standard railway motors mounted on the axles. The car is operated the same way as ordinary electric trolley cars, by means of a suitable controller. A 100-gal. storage tank supplies sufficient gasolene to carry the car 200 miles. The car is provided with automatic and straight air brake equipment, auxiliary hand brake for use in case of emergency, and also with the standard automatic air signals.



Gas Engine and Generator; Gas-Electric Car.

Passenger Compartment, Gas-Electric Car.

A trial trip was made from Schenectady, N. Y., to Rochester, via the Auburn division, a distance of 244 miles, by officials of the New York Central Lines and the General Electric Company. The trip was thoroughly enjoyed by the passengers, the absence of smoke, cinders and gas being specially noticeable. The smoothness of operation and ease of control were subjects of

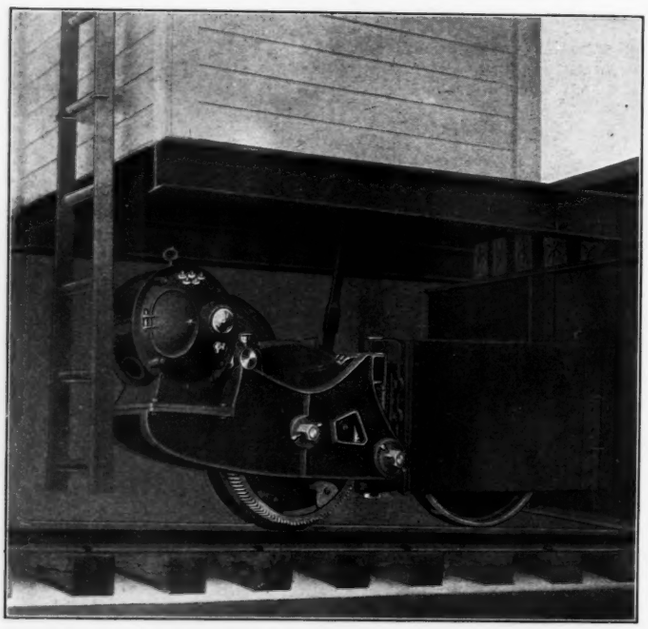


Gas-Electric Car for Buffalo, Rochester & Pittsburgh.

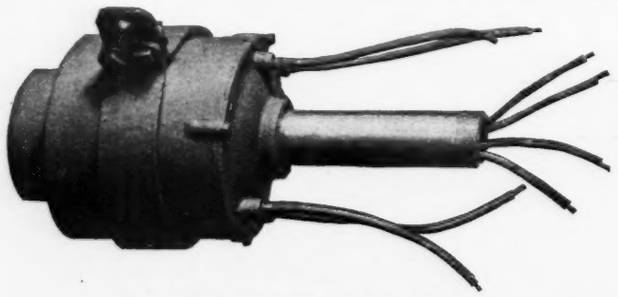
favorable comment, and the speeds attained on the heavy grades were satisfactory. This type of car is adapted for use on branch lines, which at present may be operated at a loss by steam, and where the amount of traffic does not warrant electrification; its use on such lines will reduce operating expenses and increase the traffic.

Heavy Service Tractor for Turntables.

The use of turntable operating devices has become quite extensive, on account of the ease and economy with which heavy locomotives may be turned on power-operated tables. The tractor shown in the accompanying illustration may be operated by either electric power or compressed air. These tractors are uniform throughout, with the exception of the motor, and can therefore be changed to suit conditions by the changing of the motors. The equipments are furnished complete with all accessories, including tractor with motor, controller and resistance, brake, waterproof and smokeproof electric connection for use overhead or in the center of the table, wooden or steel



Electric Tractor for Turntable.



Contactor for Electric Turntable.

operator's cab with sanding device and all wire and conduit. With the air-operated machines outfits are furnished having brake, cab with sander, and air connections if desired. These machines are manufactured by the Weir & Craig Manufacturing Company, Chicago.

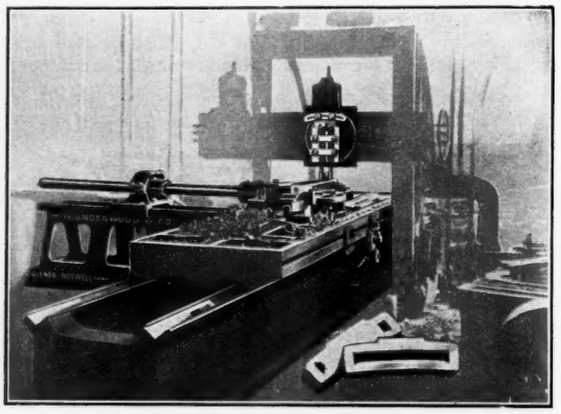
The cost of building the line, including the reconstruction of the existing light railway between Herby and Czenstochova into a broad-gage line, and all the buildings, rolling stock, etc., has amounted to about $3,500,000, on which there is a government guaranty of 4½ per cent. per annum. It seems that the shares of this company are chiefly in the hands of Germans and Russians, but the officials are taken chiefly from the locality.

Shop Equipment.

Radius Adjustment for Planing Motion Links.

A review of nearly all of the devices for machining valve motion links and a careful study of their contruction, with a view to obtaining something that would permit rapid work and accuracy and still be of such construction that wear would not interfere with the exactness of the work, has led to the design and application of the radius planing attachment shown in the accompanying illustration. It was found that six points had to be considered to secure a device that would best suit the requirements. These points are: An absolute correct circle radius; a rigid construction permitting heavy cuts; a wide range of adjustment to any radius needed for links; absence of wear on all parts which would impair the accuracy of the curve; an easy adjustment of radii and of changing and rechanging the radius cutting with straight planer work, and a concentrated method of curve cutting, so that the work may be completed in one operation.

These points are claimed to have been covered in the Allner-Boswell radius attachment, which is made by H. B. Underwood & Company, Philadelphia, Pa. This attachment is applied by rigidly fastening the bottom plate of the device to the table. This plate is made with a square block, over which fits an enlarged pin which is the bearing for the top plate of the setting table. The table is oscillated on this pin by a radial bar which is centered out to one side, as shown in the illustration. The radial bar is in the form of a tube, and being comparatively light, is easily handled. The adjustment to radii of different lengths is accomplished by changing the position of the guide, which is double-pivoted in a post sliding on the outlying foot plate. This attachment allows for heavy cuts and stands up to the limit of the machine tool without injury. After the link has been planed, milled around the edges, and the end clearances drilled and slotted, it is set up on the chuck table and the center block removed with two parting tools working simultaneously. This parting operation, including setting up of link and lifting out of block after parting, has been done on a 15 h. p. planer in 35 minutes, the link being of hammered steel 3½ ins. deep. After parting, the slot is finished by side tools, which are always kept set up in the other tool heads of the planer. The advantage of this method consists in having one setting for blocking out and finishing both sides, and in the correctness of the inside and the outside radius. The attachment is used not only on links, but also on dies, quadrants, curved stone, etc.



Planer Equipped for Motion Link Work.

Hydraulic Press for Light Work.

The small hydraulic press, which is here illustrated, was designed by the Watson-Stillman Company of New York, and has proved useful in machine shops, where small parts are press fitted, or where a high pressure must be brought to bear on any small article, whether for bending, straightening or flattening. The convenient size permits this press to be mounted on a light truck and hauled from place to place, and its operation is quick and easy. Quick movement of the ram may be made by the lever and connecting links shown at the left. The handle

at the right, on the extension lever socket, will operate the pump easily where only light pressures are required, but by applying the extension lever the press will develop a pressure of 30 tons. The platen area is 8 in. square; the platens are

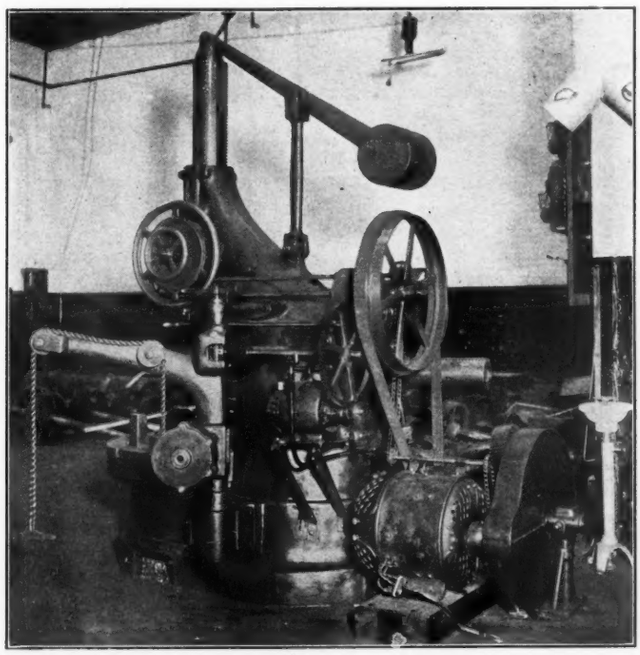
Hydraulic Press for Small Work.

8 in. apart at maximum opening and the ram movement is 4 in. The base is 12 in. x 16 in. and the height of the press over all is 27 in. The main cylinder is a steel forging, machined to fit perfectly into the reservoir, and the pump cylinder is of bronze. This press is designed for severe service and is ideal for small work requiring high pressures.

Individual Motor-Driven Machine Tools.

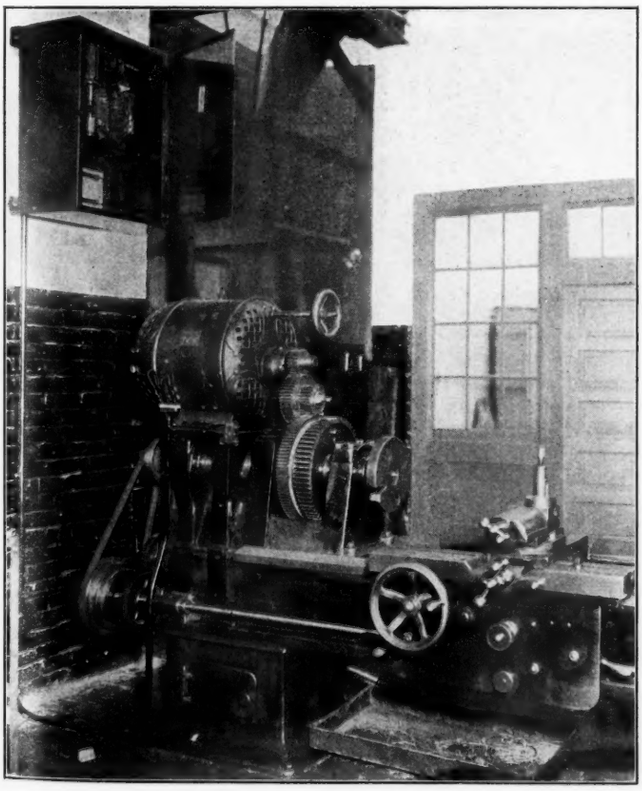
The Chicago Railways Company recently converted the entire equipment of its machine and woodworking shops on West End avenue, Chicago, to individual motor drive. In the engineering details pertaining to the application of motors to the different machines, the engineers of the railway company were assisted by those of the Reliance Electric & Engineering Company, Cleveland, Ohio, who furnished the motor equipment. This installation is unique in several particulars and uses automatic starters for the control of the individual motors. These starters are used not only for the constant speed motors, but also with the adjustable speed motors.

The objects in making these changes were: To effect a saving in power by making possible the use of individual machines, especially for overtime work, without running a 75 h. p. motor

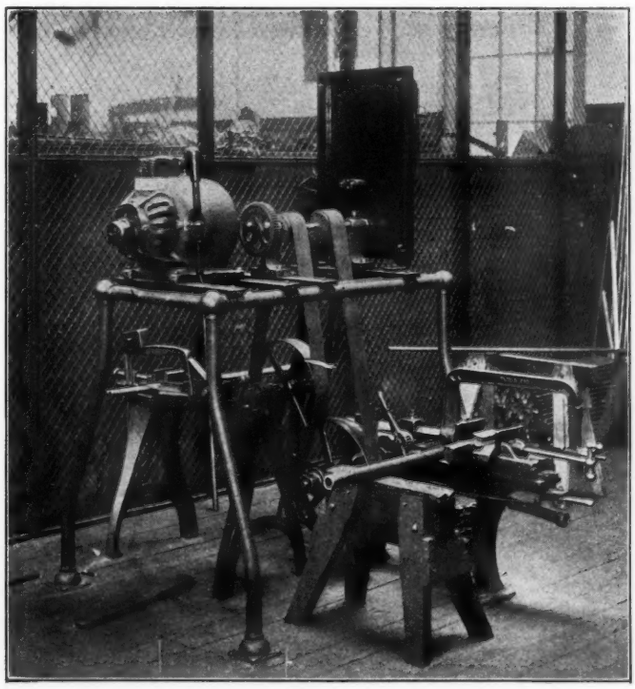


48-in. Car Wheel Boring Mill driven by 7½ H. P., 500 to 1500 R. P. M. Motor.

which was formerly used for driving the entire line shafting of the machine shop; to increase the productive efficiency of the machines by a more powerful drive with an easy and convenient method of speed control over wide ranges; and to increase the general efficiency of the shops by a machine arrangement which would afford the greatest convenience in the handling of material. In planning the installation a number of difficulties presented themselves. One problem was to have as

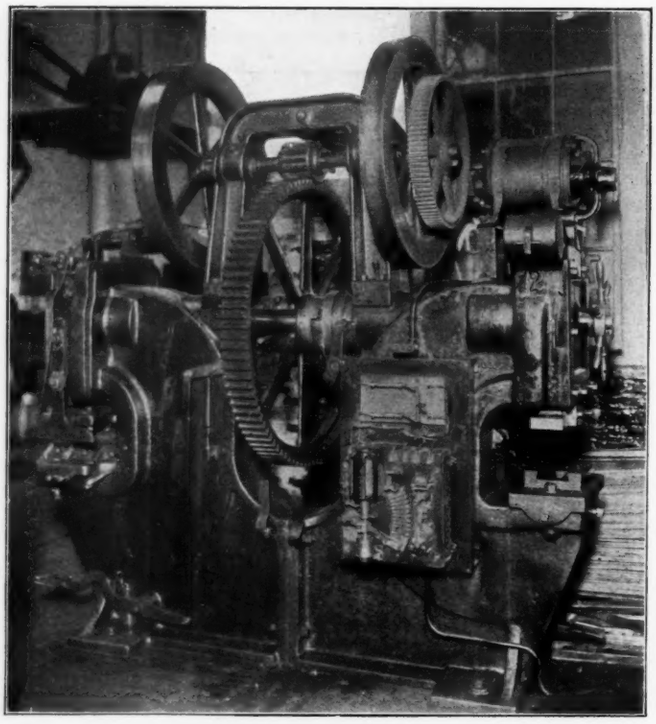


Engine Lathe driven by 5 H. P., 300 to 1800 R. P. M. Motor.



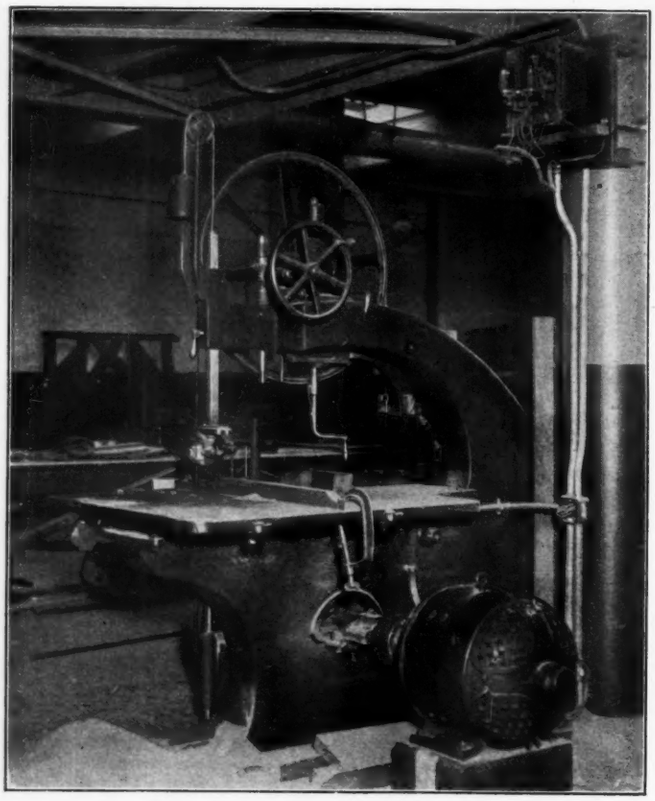
Two Hack Saws driven by 1 H. P. Motor.

little wiring as possible on the machines, as the motors are installed on a 550 volt d. c. grounded circuit, the power being taken from the company's own lines. The only wiring needed on the machines is for the push buttons which require a pilot circuit carrying only about ⅛ amperes. In the selection of auto-



Punch and Shear driven by 7½ H. P. Motor.

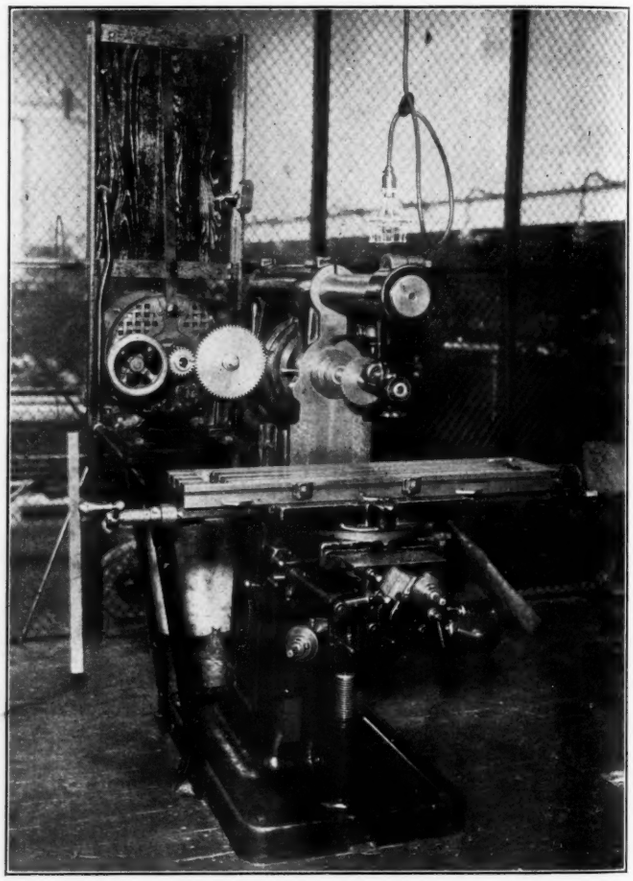
matic starters, the first consideration was the protection of the workmen from the high voltage, and the second, the elimination of any possibility of abuse to either the motors or the starting equipment. In the case of the adjustable speed motors the choice of suitable controlling equipment proved more difficult.



Wood Band Saw driven by 5 H. P. Motor.

When belt-driven tools, equipped with cone pulleys, are changed to motor drives, it is necessary to remove the cone, which in some types was designed to cover a wide range of speeds with only a single back gear. The Reliance adjustable speed motor of the armature shifting type was selected for this service for the following reasons: It eliminated the electrical field resistance controller, which often causes electrical troubles and is dangerous to operators, due to the high voltage; it permitted the use of the same type of automatic starters which had already been chosen for the constant speed motors; and the wide range of speed possible with this type of motor reduced the number of gear changes to a minimum.

The accompanying illustrations show several machines which were converted to individual motor drive. In the illustration of the lathe an example is offered of the method employed in making the changes. The cone is replaced by a quill, the motor driving this quill through an intermediate idler shaft so as to



Milling Machine driven by 2 H. P., 400 to 2000 R. P. M. Motor.

get a double reduction. This intermediate idler shaft may either be supported from the base casting, as shown, or from a suitable boss on the vertical arm of the motor end yoke. A stationary stub shaft is used for these idlers, the two idlers being mounted on a common bronze bushing. In this case the back gear ratio on the belt-driven machine, which was 1 to 10, was changed to 1 to 6. Using a motor with a 1 to 6 speed ratio, this gives a continuous 1 to 36 range of spindle speeds, which is satisfactory for lathes of this size. If a motor with only a 1 to 3 speed ratio is used on such a lathe, an additional gear change must be provided or there will be a jump or gap of over 300 per cent. between the range of spindle speeds obtained with the back gear in and those obtained with the back gear out. By changing the back gear ratio to 1 to 6, and using a motor with a 1 to 6 speed ratio, a continuous range of spindle speeds was obtained without any gap. It is a simple matter to change the back gear on a lathe of this character from 1 to 10, to 1 to 6. It merely means changing the diameter of the two tail gears without any change in the face gears or in the locking device between the large face gear and the quill. In making the change in the two tail gears they may be moved as shown in the illustration, allowing the motor to be set low over the head.